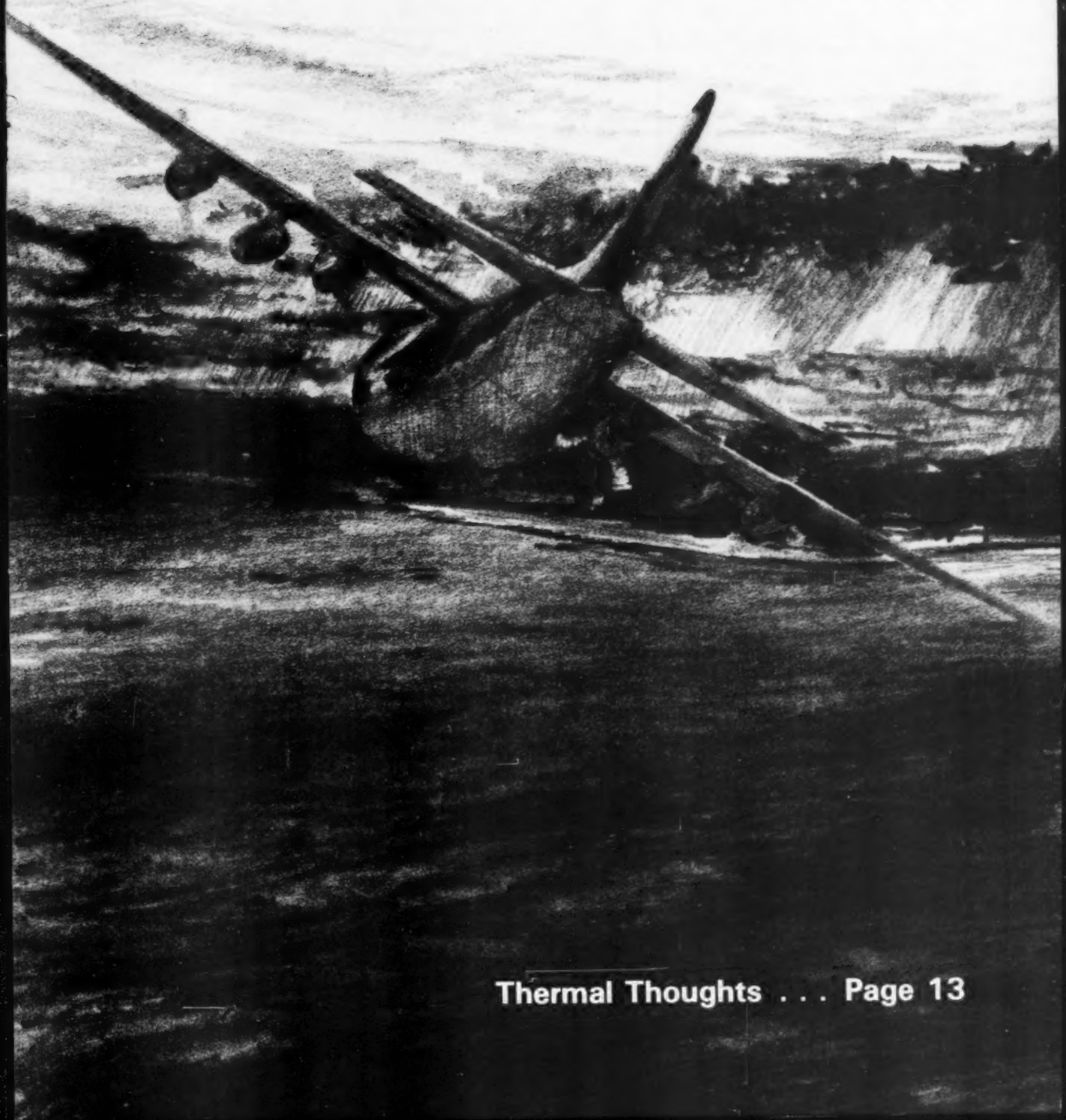
THE MAC Flyer

MAY 1987



Thermal Thoughts . . . Page 13

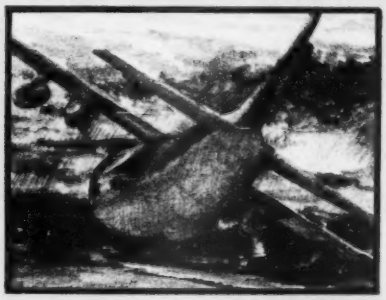
THE MAC Flyer

For Greater Safety in MAC Air Operations

May 1987 | MACRP 127-5 | VOL XXXIV NO. 5

Gen Duane H. Cassidy — Commander in Chief
Maj Gen James D. Kellim — Inspector General
Col Richard W. Blatter — Director of Safety

Maj Thomas C. Weinzierl — Supervising Editor
Maj Michael J. Iltis — Associate Editor
Capt Donald L. Rosenberry — Associate Editor
Mrs Frances A. Caldwell — Managing Editor
Mr Tom O'Laughlin — Art Director



page 9

page 13

About the Cover: Original artwork by Tommy O'Laughlin

FEATURES

3 **Mission Oriented**
Head up and locked!

7 **Safety Workhouse—The FSO**
Part V—Hazardous cargo.

9 **An Alternate Approach**
Just in case.

13 **Thermal Thoughts**
Heat stress hurts!

17 **Thunderstorm!**
That time of year again.

21 **Critical Triangles Of Agreement**
Check the triangle.

25 **Aero Club Lesson**
Prepare *now* for that emergency.

DEPARTMENTS

6 **Excellence In Airmanship**
24 **Flying Hour Milestones**
27 **Quick Stoppers**
31 **After Deadlines**

The MAC Flyer is published by the Director of Safety, Military Airlift Command. The contents are informative and not regulatory or directive. Names of people and places in mishap stories are representative and not necessarily of the aircraft or equipment involved. Information in any article may not be construed as incriminating under Article 31, UCMJ.

Contributions, comments and criticisms are welcome. Write: *The MAC Flyer*, HQ MAC/IGFE, Scott AFB, IL 62225-5101, or Autovon 576-3534. The editors reserve the right to make any editorial changes in manuscripts which they believe will improve the material without altering the intended meaning.

Subscriptions are available from: The Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Changes of address for subscription mailing should be sent to GPO. Give both old and new addresses, including zip codes. USAF Active and Air Reserve Forces units establish requirements for this magazine through their publication distributor (DAPD). Other U.S. Military units should consult administrative directives. *The MAC Flyer* is published at an approximate ratio of one magazine for every five MAC aircrew members, and one for every twenty MAC Support personnel. Distribution X; OPR: HQ MAC/IGFE ISSN 0024-788X.

MISSION ORIENTED

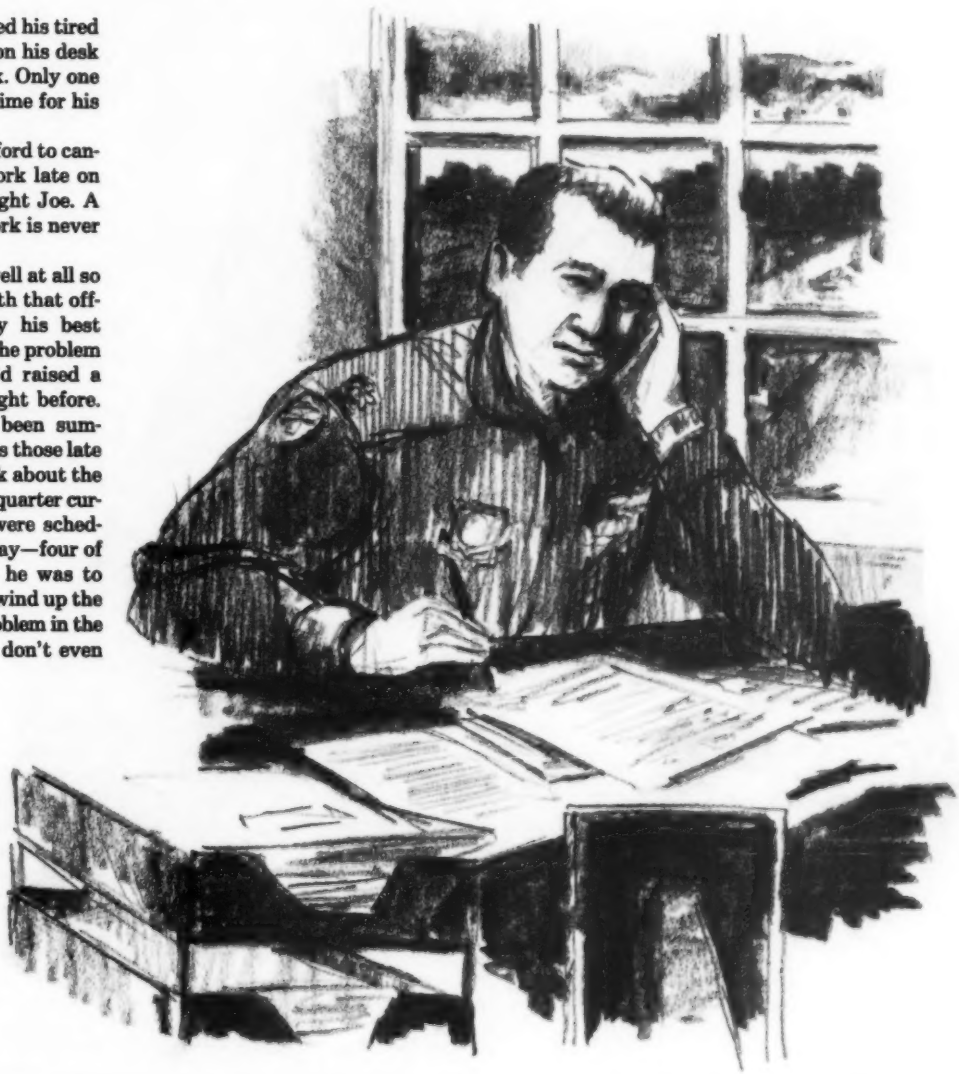
I sure would like to know what you were thinking about out there . . . .

by Lt. Col. Edward M. Duchnowski
97 MAS (Assoc), McChord AFB, Washington

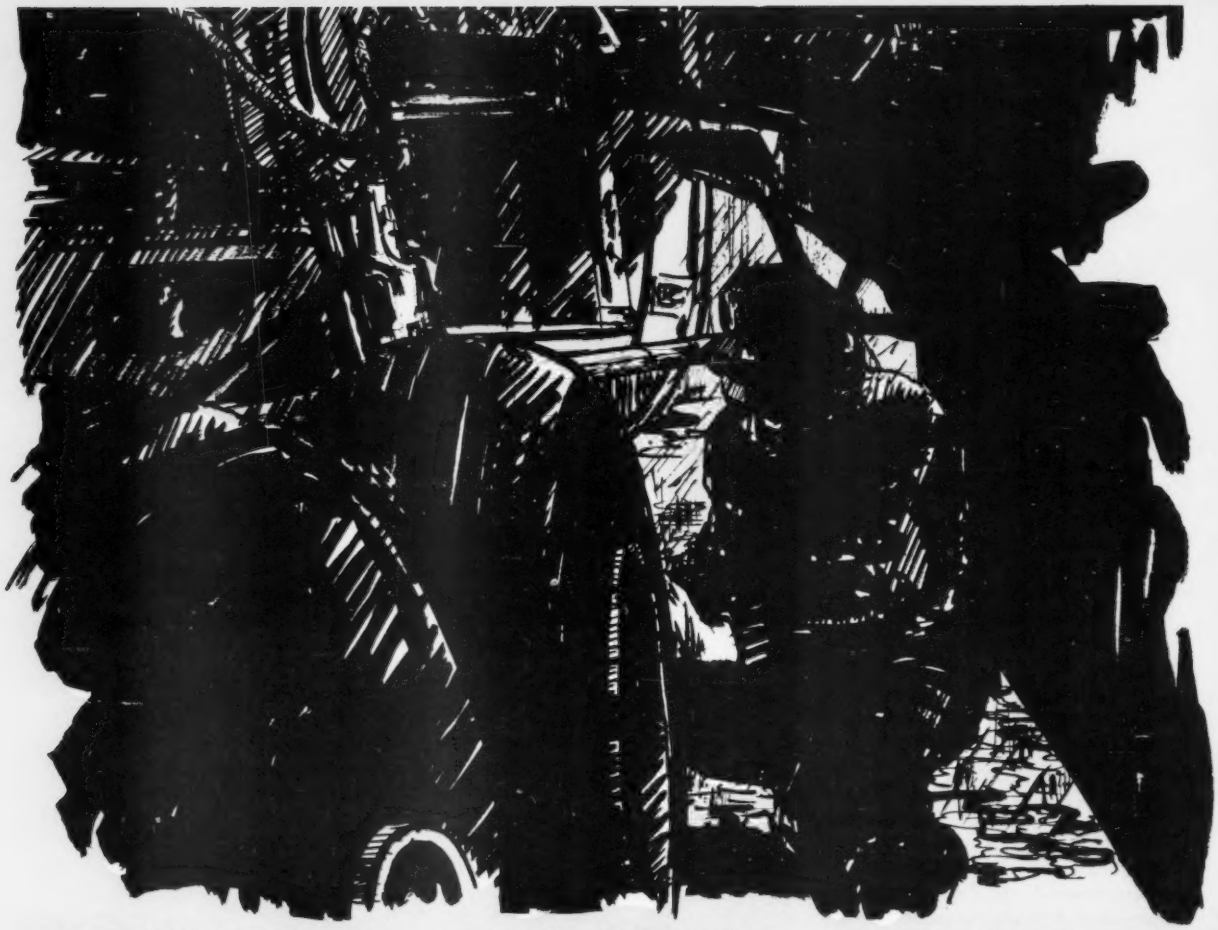
Lt. Col. Joe Beale raised his tired eyes from the mess on his desk and gazed at the wall clock. Only one hour remained until showtime for his local training flight.

Lord, I wish I could afford to cancel tonight's flight and work late on these blasted OERs, thought Joe. A squadron commander's work is never done.

The day hadn't gone well at all so far, beginning as it had with that off-DZ airdrop performed by his best airdrop crew, followed by the problem with a crewmember who'd raised a ruckus at the club the night before. Then, an hour ago he'd been summoned by the DO to discuss those late OERs. Now he had to think about the ten pilots in need of end-of-quarter currency requirements who were scheduled to complete them today—four of whom were on the flight he was to command. All I need is to wind up the quarter with a currency problem in the squadron, thought Joe. I don't even



HONORABLE MENTION 1986 MAC FLIGHT SAFETY WRITING CONTEST



want to think of the DO's reaction.

As Joe was reflecting on some of his problems as a new squadron commander, MSgt. "Skip" Reynolds, who was to be Joe's flight engineer on the evening local, was having problems of his own. Damn this traffic! The old man will have my hide if I'm late for his local tonight, Skip was thinking quietly.

Skip, due to retire next month, was flying late night locals so he could spend his days getting his flight engineer turbo-jet rating. The school, conducted by Olympic Aeronautical Academy, was thorough and rigorous, and would hopefully help him obtain a job with a foreign carrier after retirement. The problem was it was a 60-mile drive from the school to the base, in heavy traffic, after a long day in class.

It was now 2000 hours. Skip was examining the insides of his eyelids in the outboard ACM seat, and Joe was in the copilot's seat as they ginned around the flagpole. One hour of flight had elapsed and so far things hadn't gone well at all. The weather was lousy, the pattern was saturated, and Joe Beale was still attempting to get his first student current, with three more to go after that. As they were vectored to base for an ILS, approach control advised them to contact command post. What now, thought Joe as he directed the pilot to monitor the Number 2 UHF and switched to command post on Number one.

"McFadden Command Post, Weeks 53."

"Weeks 53, McFadden. Be advised a vehicle reported pieces of tire tread on the runway after your last touch and go. Request your intentions."

Joe cursed to himself as he tried to absorb the situation implied by the radio call. Even as he replied to command post's inquiry and stated he would enter holding, inspect the landing gear, and advise, his mind was racing to cope with the impact on the mission caused by this sudden turn of events.

At minimum, I need another hour and a half in the pattern to finish training everyone, and that's without further delays caused by weather and traffic, which I know there's gonna be, thought Joe. He glanced at his watch. Quiet hours start in two hours and twenty minutes, he figured. If we really do have a blown tire, the emergency procedures, approach and landing,

fire department inspection, towing, and tire change will take eons. There is just no damn way I can hack the mission now. Boy, the old man's gonna be ticked! These and more thoughts went through Joe's head as he switched back to Number 2 radio, informed the left seat pilot that he was back on, and then radioed approach control requesting holding.

In quick succession, Joe fired rapid commands to the scanner to inspect the wheel wells for a possible blown tire, to the engineer to get out the Dash One for procedures on landing with a flat tire, and to the left seater to enter holding. Even as Joe was finishing his flurry of commands, Sergeant Reynolds, his flight engineer on scanner duty, was heading downstairs, although he was not fully alert. Skip, just awakened, had a headache and his eyes were still glassy with fatigue. As he proceeded to inspect the gear wells, he struggled to overcome fatigue as he gazed into each one intently. His inspection, however, revealed nothing.

"Pilot, Engineer, I can't see anything unusual down here, but it's pretty dark. Wanna try lowering the gear? Might make it easier to see something."

After the second check, this time with gear down, still revealed nothing, Joe announced over the interphone, "Well, we may or may not have a tire problem, but we're gonna plan for the worst and hope for the best." As approach control began issuing radar vectors, Joe again called command post.

"McFadden Command Post, be advised that our inspection did not, repeat, did not reveal a blown tire. We have, however, declared an emergency and plan to full stop and check it out. If it turns out everything's okay, we plan to taxi back and take off again to finish our requirements."

"Roger, Weeks 53, that sounds like a good plan. Please advise if you need further assistance."

Weeks 53 was now stopped on the runway. Skip was on the scanner cord outside while the rain came down in buckets. Firetrucks swarmed around the aircraft, red lights flashing, while Joe attempted to find out what the situation was.

"Scanner, copilot. Do we or don't we have a tire problem?"

"I don't know, boss. It's so dark and wet out here I'll have to go off the cord and go back and check."

"Roger, go ahead," replied Joe as he switched to the radio and called tower.

"McFadden tower, Weeks 53. Be advised that we are terminating our emergency."

"Weeks 53, McFadden tower. Be advised the fire chief wishes to check you over some more before withdrawing emergency vehicles. Please stand by. Also, command post requests you give them a call."

Thoroughly harassed and up tight, Joe muttered a few expletives as he practically wrenched the radio selector switch out of its socket and switched to command post. Meanwhile, outside the aircraft, Sergeant Reynolds was having problems of his own. Unable to see enough of the left wheel assembly to determine if the inboard tire was damaged, he decided his best alternative would be to enter the wheel-well. As he crawled under the gear pod, he could see the fire marshall just completing an inspection of the right side of the aircraft.

"McFadden tower, Weeks 53. How much longer is the fire marshall going to take before he releases us?" requested Joe in a less than pleasant tone.

"Weeks 53, stand by."

Joe glanced at this watch again. One hour and forty-five minutes left until quiet hours. When was that fire marshall gonna get out of the way and let him complete his mission? Just as Joe was contemplating this and other dark thoughts, the radio call came from tower.

"Weeks 53, the fire marshall advises he has completed his inspection. You are cleared to taxi."

"About time," said Joe. "Let's get outta here."

With that, Joe mashed the brakes, heard the parking brake release with a highly audible click, and began adding power while he said "clear right" and dropped his feet from the brake pedals. Just as the left seat pilot swiveled his head to clear outside, the jump seat pilot yelled, "Sir, the scanner!" Joe's heart leaped into his throat as he slammed on the brakes hard. The aircraft had moved approximately two feet.

Outside, in the rainy cold darkness, Skip was lying on the runway as he groaned and held his head. He had heard the engines winding up, and in a split second his body was in motion as his mind realized the horrible implications of the sounds he heard. He had exited the wheel well in a blind panic, smashing his head on something hard while doing so.

"Well, Joe, Sergeant Reynolds is in the hospital with ten stiches in his scalp, I have to disqualify a squadron commander as a result of tonight's mess, and I've probably got an engineer section that lost a lot of faith in that same squadron commander. I suppose it could have been worse, nobody was killed, thank God, but I sure would like to know what you were thinking about out there. It sure wasn't flying airplanes!"

Joe Beale looked sadly at the wing DO and said, "Unfortunately, sir, *I'm afraid it was.*" ✯

Lieutenant Colonel Duchnowski was commissioned through ROTC where he graduated as a DG. He is a qualified C-141 instructor pilot with approximately 7,000 hours of flight time. A former wing chief of safety and ADO, he is presently an air carrier inspector with the FAA, flying Fokker 28 and Boeing 757/767 aircraft.

Excellence In Airmanship

From Left to Right: Capt. Robert E. Tillema, Capt. Frank S. Kersten, MSgt. Michael M. Stoyle, SSgt. Lowell H. Tash, Jr.

Capt. Robert E. Tillema and Crew, 41 ARRS, McClellan AFB, California, displayed outstanding airmanship during a 30 Oct 1986 night sortie while practicing night aerial refueling over rugged terrain. After several dry contacts, Captain Tillema, the aircraft commander, performed one more dry contact on the right hose of the HC-130. The HC-130 AC directed a practice breakaway, and the helicopter returned to the right observation position. Just after moving the aircraft into right observation position, MSgt. Michael M. Stoyle, the flight engineer, initiated fuel transfer. Captain Tillema,sitting in the right seat, felt a slight flight control input (not a normal occurrence in the HH-53) followed immediately by relay chatter. With that, the helicopter's lights began flickering on and off. Captain Tillema had his hands full, because with each flicker, his Automatic Flight Control System cycled on and off giving him major flight control inputs. He began an emergency transmission to the HC-130, but before he could say anything, both generators failed, the aircraft experienced complete electrical failure, and was plunged into darkness. The three crewmembers in front, Captains Tillema and Kersten and Sergeant Stoyle, began yelling to each other for coordination while entering a power-on-descent. There was a momentary flicker of electrical power, then a return to darkness. SSgt. Lowell H. Tash, Jr., FE, began reading from the Dash One and advised the crew to land as soon as possible. The aircraft approached 1,000 ft MSL without a landing area in sight. The crew reasoned if they *did* find a suitable landing area, the only possibility for a safe landing would be a high hover with Sergeant Tash attempting to identify landing obstacles with his flashlight. Captain Kersten suggested they start the auxiliary power plant (APP). This was just a "stab in the dark," because the number 2 generator can be run either by the main rotor gearbox or the APP, but they had not been able to reset the generator. However, Captain Tillema gave approval, and Sergeant Tash started the APP. They made one attempt to reset the number 2 generator, and it worked! The crew found a suitable area, and made an uneventful landing. Had they not restored power, the landing might have had a different result. Maintenance personnel found a bad supervisory panel (the panel controls the output of the generators) and a disconnected cannon plug on the number 1 generator. When the cannon plug disconnected in flight, the supervisory panel evidently could not handle the overload and failed the number 2 generator. This is the first total electrical failure at night in the HH-53. There is no guidance in the Dash One other than to land as soon as possible (day) or bail out (night IMC). The elapsed time from initial failure to landing was only four minutes. This crew's outstanding handling of a dangerous situation prevented the possible loss of human lives and that of a valuable aircraft. *TMF* staff extends its congratulations for a job well done.

Part V - Nuclear Surety & Hazardous Cargo

by Lt. Col. Michael G. May and
Capt. Donald L. Rosenberry

In this article, many of you FSOs will, hopefully, experience some broadening in your job responsibility awareness. As FSOs, you're interested in anything affecting flight. Transportation of nuclear weapons and explosives (or any hazardous cargo) are two areas that have a lot to do with "MAC flying." So, what do they have to do with your job? This article will focus on duties of an additional duty nuclear surety officer (ADNSO). It's OK for explosive safety people who tackle this duty to read this too. We'll leave instructions for Prime Nuclear Airlift Force (PNAF) programs to experts in the Nuclear Surety Division.

First of all, you can't imagine MAC having a nuclear mishap, can you? That's why care and feeding of our nuclear resources takes *TOP PRIORITY*. We go so far to ensure we don't have a problem that all equipment used to move nuclear cargo undergoes a special certification process *before* designation as nuclear certified. Equipment so certified is listed in TO 110-N-16. Therefore, any units with pickup trucks, forklifts, pallets, cargo tiedown devices, aircraft power units, or any number of very common pieces of equipment must also have a nuclear surety program. That includes just about everyone, and here's why. A cen-

tral part of a nuclear surety program is reporting certain malfunctions of nuclear certified equipment. You'll find out what "certain" means from AFR 127-4, and TO 00-35D-54 has the recipe for these special reports. They're called CAT 1 MDR, DULL SWORD reports and they're really more interesting than their name implies. By the way, if you haven't taken a look at the Dash 54 by now, you need to. You'll find a CAT 1 MDR is required (instead of a CAT 2) for all aircraft mishaps, and you could run into a little known but interesting requirement for all CAT 1 MDRs to receive chief of safety coordination in two places prior to transmission. Your Vehicle Maintenance (LGTM) folks are experts on MDRs. So, talk to them about DULL SWORD requirements and set up a system to accomplish the report if something goes wrong with some of your unit's equipment. There's another agency on base that plays a large role in these reports—aircraft maintenance. They also need a system to identify pieces of broken equipment requiring DULL SWORD, CAT 1 MDRs. Many wings have automated their system and can readily identify nuclear certified equipment from computerized vehicle master ID lists. If you haven't done that yet, it would be worth your while. Whatever system you decide to use, make sure these two agencies, LGTM and maintenance, know the score on DULL SWORD, CAT 1 MDRs and use them when required. To check the system, walk through a report for a hypothetical piece of equipment to see if it would be identified and reported correctly.

Another requirement all CONUS bases have is a SAFE HAVEN plan. If a Department of Energy (DOE) vehicle is transporting nuclear related cargo and has a problem, the driver might need to duck into your base for security, repairs, or other support. Review your plan to make sure it provides proper response and support. Try it out!

C-141 and C-130 bases are responsible for emergency nuclear airlift operations as described in MACR 55-16. Additional duty nuclear surety officers must be familiar with this training and review the program annually to include observing ground training. Take a look at this regulation to ensure your nuclear surety program is up to speed.

I said at the beginning I wasn't going to address Prime Nuclear Airlift Forces. I lied. For those bases identified as Principal Nuclear Airlift Support Bases (see MACR 127-1, para. 6-10), there's a bit more to your nuclear surety program than we've identified so far. You must be prepared to receive an unprogrammed divert of a nuclear-laden aircraft. Requirements for your plan are listed in AFR 55-14 and MACR 55-18. In order to ensure your base is capable of supporting this plan, make sure you schedule a practice session at least once a year. Disaster preparedness and the base 355-1 plan should be big players in this exercise.

Let's mention one more element of the nuclear surety business with which you all need to be familiar. It's known fondly by NSOs as the Personnel Reliability Program, or PRP for short. The requirements are spelled out in AFR 35-99 — one of the more fun books to read. Nevertheless, like many other regs you should read occasionally, you need to be familiar with PRP. The goal of PRP is to limit access to nuclear components to those that have been properly certified. Take a look at PRP in your unit. Sometimes explosive ordnance disposal and security police personnel will be on PRP. At least one location has civil engineers included in the program. Get to know your wing's requirements/mission and find out how you can strengthen its operation.

Now let's discuss FSO concerns regarding hazardous cargo. Hazardous cargo presents aircrew members and ground support personnel with a multitude of problems, but most of them can be solved by a combination of things—knowledge and proper, thorough planning. Emphasize to your ACs they must demand to know what's onboard their airplane so they can take required precautions. One good technique to preach is for ACs to act as if there isn't anyone else doing anything to coordinate your special category cargo. That way, they will remember to personally make sure everyone with a need knows they have hazardous cargo aboard. We've got a good system—really! But, ACs can add to its effectiveness and reliability by backup actions. Here are two more helpful hints from our exploders you need to emphasize to your aircrews:

0 Check PRP requirements—are they included in your mission setup?

0 When you give the 30-minute-call for explosives cargo, use DOD Hazard/Class Division like 1.1, 1.2, 1.3, or 1.4 instead of the DOT Class A, B, or C. Everyone should be using DOD references.

While we're on hazardous cargo, let's address the leaking cargo problem. HQ MAC/IGFX is our OPR to ensure these mishaps are thoroughly investigated. They've conducted extensive crosstalk with other services to help eliminate leaking cargo incidents. In your unit, some safety person needs to take the investigation and run with it when these reports come in. Crewmembers must thoroughly document the incident and safety folks need to move with alacrity to complete the investigation. In these cases, "time is of the essence" (ask your JAG about that phrase) and the entire investigation may be lost if we don't move fast. One more thought; *you* need to brush up on how to handle hazardous cargo because *you* may be the safety *expert* in the field during exercise/contigency operations. You'll feel like you were in a shopping mall with your pants down if you aren't familiar with rules and regulations for handling hazardous cargo. Use your explosives safety officer/manager to learn some tricks of the trade and become conversant with AFRs 127-100 and 71-4. You'll need to know about clear zones, compatibility, and fire fighting as a minimum. As I said in the beginning, this article will broaden your horizons. At least you won't be able to say "But nobody told me I had to do that."

One more philosophical tidbit relating to your job; it provides a great opportunity to learn a lot about your unit's operation. But remember, safety is an open-ended business. When quitting time comes around, don't expect to leave with the feeling you've met your quota, or done everything you could to ensure safe operations. There's always something else you could have done, said, read, written, inspected, etc., to enhance safety. Keeping mishap rates down comprises part of your payback. The record shows you're doing an outstanding job. Use the helpful hints in this article to improve your program, keep the skies safe, and "MAC flying" fun.

An Alternate Approach

Are *you* ready?

"*Great* briefing, Pilot!" the sarcasm literally dripped off the words onto the C-130 cockpit floor. But that's Ric—a cynic to the end. Even way back, when Mac first met then-1st Lt. Richard D. Gracon in survival school, he'd been of the same mold. That was some eight years earlier, but he hadn't changed much. "I especially like the bit about the plan for what we'll do if our destination is below minimums and our first alternate has bad weather as well. But didn't you cut it a bit short? After all, when I make an approach briefing, I always include what we do if our *second* alternate's no good," he continued.

"Okay Gracon, I see what you're driving at, but I think you've missed the point altogether. Where we're headed, we don't have all that many suitable alternates. As it turns out, our first alternate just isn't that far away from our destination, and while the forecast is for acceptable weather at our alternate, you never know for sure."

"C'mon Pilot. You know as well as I do we only file an alternate because we're overseas and FLIP says we have to; it's got nothing to do with weather conditions."

"The weather forecast wasn't exactly for fair weather. You've been flying over here for a couple of years, you know how quickly weather patterns can change. The best plan is the one you arrive at *before* you start the approach. For these long overwaters, checking out the options before ETP is my personal rule of thumb."

"Yeah, but you need to have a built-in stopping point somewhere. You sound like Winkie, the Wonder Dog, preeching all this fine third alternate to the change to the annex nonsense. We just don't fly that way!"

"Easy, Copilot. I *did* stop after I'd come to the point of reason. Let's face it, the verbage on picking an alternate outside the destination weather pattern isn't all fantasy. Humor me on this one and let's press. Truce?"

Ric smiled his famous "I just ate a bug" smile and pushed his chair back. "I warned you, I'm watching you on this trip. You know how I've always felt; if you're going to fly, then you're going to fly, and if you're going to push paper then you're *not* going to fly, not with me at least. Reality may have softened the perspective some, but the gut feel is still the same. You're going to have more crew coordination on this flight than even you can handle. But for now, clear me off so I can go back and stretch. Sure wish we had afterprops. I can taste the steak at Nick's already."

"What, you've got a favorite food stop in Bangkok, too? I think you guys get too many 'good deal flights' over here. I'll take that as a friendly commitment to good crew interaction, Ric. You're cleared off."

"You call six and a half hours over water to a destination plagued by many thunderstorms a 'good deal flight?' *You've* certainly got an unusual point of view." Capt. Benjamin R. Greimm had a reputation for being a bit stiff, but he was an excellent navigator.

"C'mon Ben, you know we've got plenty of room to maneuver once we get there, it's always like that."

"Sure Ric, and I remember all too well that diversion, *sans* dip clearance into Singapore. I'm pretty sure we don't want to try that again."

"No problem Ben. Our hero here, Wonder Dog, has that all prepared. He's lined up every airfield in the Pacific for alternates, just in case. But enough of that. Before he comes unglued I'm off interphone to get clearance on request. You guys be sure and review our plans one more time. We only have another hour and we'll be there!"

"Forgive him, Ben. Once he starts talking, he can't stop 'til someone tells him he made sense. I'm glad to see somebody else thought the weather at Bangkok deserved a bit more attention. That's why I asked for the extra 10,000 pounds of fuel, so we can divert if necessary, and yes, we've got dip clearance if we need it. Ric wasn't *all* wrong."

"Well, we're well past the overall ETP, but with the extra fuel we've got no real problems. We've got enough to get overhead, make a couple approaches, and still make it back to Singapore with sufficient overhead."

"Now there's some fine thinking! What's with you guys anyway? We're not on a flagpole flight, you know. Where are your 'mission-hacker' hats? The embassy counts on these support runs. Besides, we're talking Bangkok! And that reminds me, did you guys know the Thai name for their capital city is the longest name for any city in the world?"

"Copilot, that's the best contribution you've made to this trip so far. But why not pretend you're a crewmember and make the last position report for us. Clark Airways is waiting patiently. Ben gave you the position report ten minutes ago. Nav, what do you show on radar up ahead? Looks a little heavy at our twelve."

"No doubt about that, Pilot. As usual, we'll be bobbing and weaving all the way in. These last hundred miles are always a thrill. Let's just hope it clears when we hit the coast."

"Clark Airways, Clark Airways, Congo 58. Position . . . ."

"Navigator, Pilot. We've been in this muck for at least 45 minutes, I'm reading 95 nm to the TACAN. Are we going to be able to turn toward the airfield soon?"

"Sure are, Pilot. I'm just driving us north of the field so we can maximize our distance from the more sporting thunderbumpers just south of the field. The pattern seems to show a V-shaped band with the airfield just to the right of the point of the 'V.'"

"Great. I'm ready to get this puppy on the ground. It's been so bumpy my favorite lunchtime chili chilito's been talking to me for an hour. So let's get the numbers, Engineer, and make this official."

"Here they are, Pilot. I've checked them already, just in case you wondered."

"Why, I'd never think of questioning you, Co."

"Pilot, Nav. We're clear of the thunderstorm line for now, you can turn base at will."

"Finally. Thanks, Nav. Call tower and tell 'em we're coming in, Copilot."

"Bangkok Tower, Congo 58 is turning inbound to intercept the 029 radial for the VOR to Runway 21R."

"Congo 58, cleared VOR Runway 21, descend and maintain 3,000 ft, report inbound. You're number 2 behind a light civilian airplane. Caution, thunderstorms within 15 nm of the field."

"Roger, Bangkok Approach."

"Navigator, Pilot. Are they talking about the same 'bumpers' you were?"

"Roger Pilot, but I don't show 'em quite that close."

"Good. Copilot, let's review these missed approach procedures. Looks to me these thunderstorms are solid, and straight ahead off the departure end of the runway. Not a wonderful thing to suddenly have to deal with on missed approach. Maybe we can get these modified."

"Well, Pilot. As the chart *clearly* shows, we'll remain inside ten miles of the TACAN. That, of course, will keep us inside three miles from the departure end of the runway when we make our left turn back to the VOR."

"Let's kill the sarcasm for now, Co. We've got weather approaching and I'd as soon concentrate on the transition from flying to grounding. We don't want it to be too sudden."

"Roger Pilot. We climb runway heading to 2,000, then turn left, climbing to 3,000 back to the Bangkok VOR."

"Pilot, Nav. We've got a 223 ft tower about a half mile off the departure end of the runway to worry about."

"Thanks, Nav. Here's my lead point, crew. We're headed in."

"Pilot, Copilot. I show you about 300 ft low. We don't start the descent to 2,000 ft until we're headed back outbound."

"Thanks, Copilot. And we're at the VOR headed back outbound, back me up so we don't exceed ten miles."

"Okay, Pilot, you're clear of obstructions; descent sounds good."

"Thanks Nav, keep the radar fine tuned for us."

"I'd start my turn back inbound now, Pilot. I'll contact Approach. Bangkok Approach, Congo 58 procedure turn inbound for 21 right."

"Congo 58, roger. Contact Bangkok Tower 118.1 or 257.8. Good day."

"257.8 good day, sir. Bangkok Tower, Congo 58 inbound, 2 DME from the VOR."

"Roger Congo 58, continue approach, check gear down. Caution, thunderstorms within 10 nm of the field."

"Roger, Bangkok. Gear down."

"Pilot, Navigator, I show you a little left of straight in on radar, and those thunderstorms really look like they're moving in quick. Let's not waste any horsepower getting this beast on the dirt!"

"Right Nav. There's the marker, we're headed for 310 ft. I plan to get there quick, maybe we can get out of this scuz. The sooner we can see the runway the better."

"Pilot, Copilot, You're significantly fast. I've got you 12 knots high."

"Roger, I'm bringing the throttles back now. The airspeed will bleed off as we level off here at 310 ft. I think I see the runway breaking out at our 12 now."

"That checks, Pilot. I've got the field just to the right at 3 nm."

"Okay, Pilot, you want I should call tower and tell'em we're visual?"

"No, I'll take the VOR all the way in."

"Pilot, Navigator. I show you ten knots slow on airspeed and low. We want to remain at least at 310 until the MAP."

"Roger. This buffeting's getting pretty intense. Nav, what's our separation from those thunderstorms?"

"Hard to tell from here, Pilot. This rainshower is wreaking havoc with the resolution on the screen. In fact, thanks to attenuation, I can only paint seven miles, and I don't trust that."

"Terrific! Copilot, stay in touch with tower about the weather. A few minutes ago they were talking about thunderstorms, and now I don't hear a thing; and increase the speed on the wipers if you can."

"Roger, Pilot. Here's more power to the blades and . . . Hey! We're still descending."

"Thanks, Copilot. I'll bump up the power a bit here, the TACAN says 3 DME, so we must be some 2.3 from touchdown. Wow! This is a bumpy ride. Loadmaster, Pilot, you okay back there?

"Roger, Pilot, everything's fine back here."

"Pilot, Co. What're you doing!? The airspeed's bleeding off way too fast! I'm coming on the controls. Cob the power! Brace for impact!"

"We'll make it, Co. We're nose high and the power's in. Co, call tower."

"No we're not! We've got full back pressure on the yoke, but look outside, we're pointing straight at the ground, and the VVI is pegged down."

"Tower, Congo 58 is. . . ."

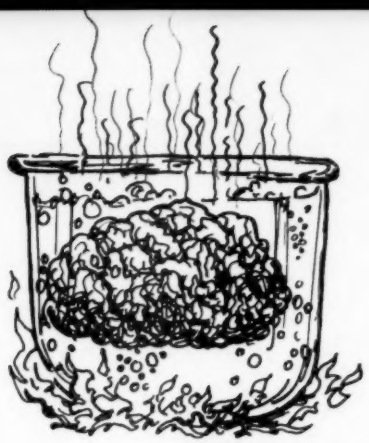
"Say again Congo 58, you were cut out . . . Congo 58, Bangkok Tower . . . Any aircraft this frequency within radio contact with Congo 58 relay, Bangkok Tower has lost radio contact with them."

"Oh, no! Dan, did you see that? It looks like that aircraft went down!"

"Yes, it certainly does. I'll go in and let the embassy know, so they can make the official requests for information and access to the site. Now remember, don't do anything until they've put out the fire and the local authorities 'invite' us in. I'm surprised they tried to land with that huge thunderstorm right out there. No way anybody made it through that."

"C'mon Mac, quit bleeding 'what if' blood all over these guys. You've been talking about what 'could have' happened since we landed at Utapao two hours ago, and we've been here at the hotel for an hour. Okay, I admit it. You made a good, no, a *great* decision at Bangkok. Breaking off the approach at the IAF and heading for our alternate was cautious, but you can't expect me to believe the fate of that little twin-prop civilian aircraft that was in front of us would have been ours. Give it a rest. You're so damned melodramatic. Maybe we hit a windshear, I'm still not convinced we did. I have to admit though, Pattaya beach for three days isn't bad at all."

"You could learn something from this as well. They just finished the report on TV regarding what might have happened. Sure, there was some misinformation on the thunderstorms, but the pilot of that aircraft should have known better. That approach was socked in. One of the most important things we can do after something like this is think about what happened, what might have happened, and yes, play a little 'what if.' It couldn't hurt your decision-making process to do what we did. We just took the rough transcript of their approach and replaced ourselves with the voices in their cockpit. It's a frighteningly believable episode. I know, I've been there before. But we weren't this time. We blew off the approach. Sure, you can say the civilian twin-prop is a lot lighter, and maybe they weren't as experienced as we are, and maybe the wind that hit them would have dissipated by the time we got there, but I doubt it. The weather doesn't usually care what type aircraft you're flying. So if you want to stay hacked about missing out on your plans in Bangkok, press on, but we're headed for a MAC shower and the road! If you're coming with us, you better get moving, we'll meet you back down here in the lobby in ten minutes!" ✈



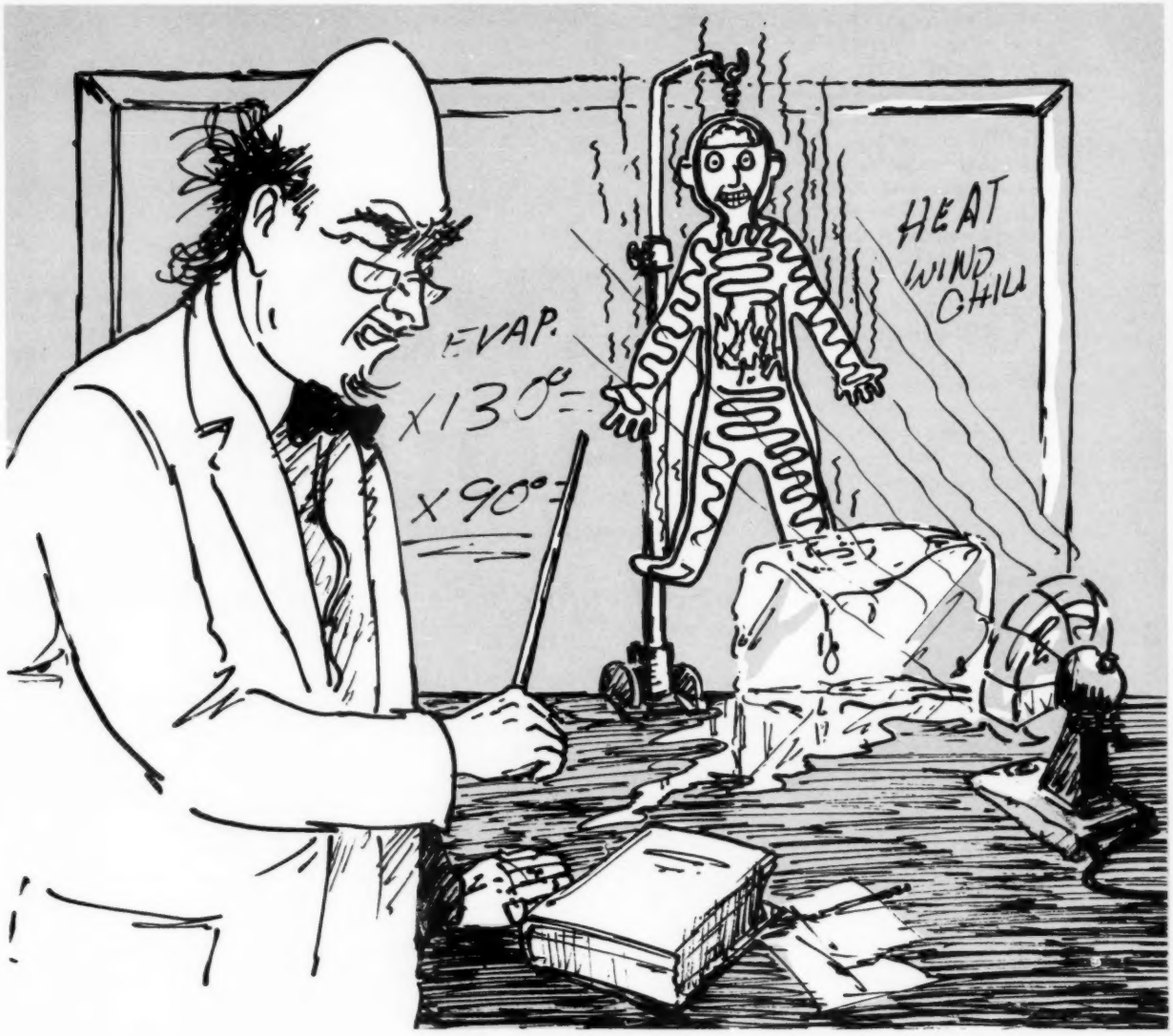
THERMAL THOUGHTS

Dr. Schliepforeber's hottest interview yet!

by Capt. Donald L. Rosenberry
Associate Editor

Ah yes, that period between the June solstice and the Autumnal equinox looms ever closer. As usual, we aviators, as well as a goodly percentage of non-aviators, are drawn increasingly to outside endeavors. There, equipped with a generous outer-coating of our favorite version of "extract of coconut," we pursue off-duty self-entertainment with a ferocity befitting one cooped up too long. While we head out into the fun and sun, there's not much we can do to alter the weather (and we probably wouldn't want to anyway). We can, however, affect the impact of said weather on our less-than-rugged frames. The goal, of course, is to survive our "rest and relaxation," preserving our ability to fly the mission effectively and safely. If we extend our fragile mortality a bit in the process, so much the better. How we approach this effort to protect ourselves is as varied as the actual weather conditions encountered, and the activity contemplated.

With us this month, to clarify the finer points of environmental protection techniques, is the incomparable, world-renowned expert, Professor Schliepforeber. Born in Spitzbergen and raised in Tanzania by small sweaty creatures, Professor Schliepforeber was recently awarded an honorary Ph.D. from the University of South Western Engineering and Technology. We obtained the transcript of an interview conducted by a reporter from UnScientific America magazine, at virtually no cost (a "slic" lighter and three marbles got us the transcript and the little 'spasio' tape recorder, nearly doubling our high-tech equipment supply).



USA: "Professor, many of our readers are aviators, and they are quite concerned about . . ."

Schliepforeber: "Gut. I begin mit a review of the principles of heat transfer. In the proverbial nutshell, we speak of four processes: conduction, radiation, convection, und evaporation."

USA: "I presume you'll be expanding on those . . ."

Schliepforeber: "You interrupt me again, and I'll be responsible for expanding a very localized area of your skull mit dis here schtick, Schlimeball! Now as I vas saying, there are four processes. I will put forth definition, take notes now! Conduction can only occur between bodies in physical contact mit one another, so you wouldn't know anything about this one. Unfortunately, ven we speak of getting rid of heat, only a small amount of energy can be transferred this way. It's a much more important topic in cold areas. Now radiation, this refers to . . ."

USA: "I know all about this one, I've had X-rays you know."

Schliepforeber: "Far too many it seems. But here ve are talking about the transfer of energy, heat in this case, between two objects of differing temperatures. Naturally, heat always moves from the relatively warmer object to the relatively colder object, so this one is also more applicable to the discussion of cold areas. In fact, it is true that both conduction and radiation lose their significance for human body temperature control when the environment reaches normal body temperature. There simply isn't anything to drive the process after that. Having said all that,

ve can concentrate on the last two: convection und evaporation. Convection is the process where heat is exchanged between an object and current of gas or liquid passing around it."

USA: "Kind of like in a spa?"

Schliepforeber: "So *that's* why your head is so spongelike! Yes, it is like what happens in a spa, only completely different. In this example we talk of the energy transfer from an object *to* the fluid, in this case, from the person who is overheated to the atmosphere. We can see this principle in action clearly in the winter, when our weather people routinely caution us that the absolute temperature is made verse by wind. We call it a 'Wind chill factor,' und it is the result of convection. Unlike the first two processes, however, this one remains effective in warmer climates, to a certain degree."

USA: "Oh, like your Doctorate, I gather."

Schliepforeber: "Mit gathering like that, the earlier hunters and gatherers would never have progressed. Ze 'degree' I speak of will become clearer as we discuss the last process—evaporation. Evaporation occurs when water passes from the liquid state to the gaseous state. For this to happen, energy (some 580 cal/gm at body temperature) must be provided from somewhere. Zis provides the most significant possibility for the body to get rid of excess heat. It is the principle mechanism ve use for thermal balance in hot environments."

USA: "Thanks, Doc. My readers will be fascinated with your explanation of the body's failsafe thermal regulator. I've long suspected those wimps who collapse from 'heat problems' were just looking for an excuse to shirk their . . . Why are you counting?"

Schliepforeber: "Eight . . . Nine . . . Ten! It is lucky for you I have been taking patience extender classes. As a token of my new-found control, try this. It's a new product I have invented specifically for folks like you who do interviews mit folks like me. It helps your chapped lips und makes the interviewee feel more comfortable. I call it 'The Interviewers Lipschtick,' the balm mit a difference. Now, what ve are talking about here is internal body temperature. Zis is one of the so-called vegetative functions of the body, which include body weight management und osmolality of the body fluids. These things fall under the control of a specialized portion of the brain known as the limbic system."

USA: "Vegetative functions, eh? Well, I would never have guessed it was an effort requiring specialized control. How amusing."

Schliepforeber: "In your case, 'specialized brain function' would describe your ability to respond to physical stimulus. Why don't you try my gift? Now, one element of this limbic system is the hypothalamus, which is critical to the thermal equilibrium we enjoy, as well as many other internal body functions. While there are obviously temperature receptors in the skin und in the spinal column, the most important ones (as far as heat regulation is concerned) are in the hypothalamus itself. Overheating this 'thermostat' causes two things to happen; you begin to sweat und your blood vessels dilate. That way your body channels internal heat from the interior to the surface via the blood, und the excess heat is dissipated in the sweat evaporation process."

USA: "Gmmmlphmmnn!"

Schliepforeber: "I see you've discovered the secret to the lipschtick—its cyanoacrylic base. Here's a dull, rusty, butter knife, you may find it useful. To continue, you begin to sweat profusely when overheated, so you might think you've got it made, but not so. There is one more crucial factor."

USA: "EEOW! Ahem. What factor is that?"

Schliepforeber: "Humidity. You see, if the air is dry, a person can stand several hours with temperatures as high as 140°F mit no apparent ill effects, but if the humidity is near 100 percent, the internal body temperature will begin to rise when the outside air is around 95°F. Und if you are working hard, this critical temperature can be lowered to around 89°F. In addition, you will be losing a lot of water und all the good schtuff that goes mit that. In fact, a person acclimatized to hot weather can lose up to four liters of water per hour, while a person *not* used to the heat will lose around 1.5 liters per hour."

USA: "Big deal, so you grab a drink and press."

Schliepforeber: "See, you're already suffering. There is a ceiling beyond which the body can't tolerate any more heat. Even worse, as this temperature is approached, the hypothalamus begins to lose its ability to regulate sweating, so you sweat less. This is the beginning of a disastrous cycle. When the body reaches about 107° F, you are out of luck, because the body can no longer regulate internal body heat. But that's not such a big deal, because at that temperature, body cells are already beginning to degenerate. Ze brain is particularly sensitive, since once neurons are destroyed, they aren't regenerated. High body temperatures like this must be avoided, since death can result!"

USA: "Aw c'mon Doc, you Ph.D.-types are always spewing off some disastrous doomsday talk. What's your suggestion—stay home unless it's cloudy?"

Schliepforeber: "In your case stay home no matter what, the world doesn't need you. But for most folks, especially the flying people you mentioned earlier, there are several preventive measures they need to know about."

USA: "Why start with the transition to the metric system now? We were talking about heat, remember?"

Schliepforeber: "You are beyond all measure of reason. Aviators are particularly vulnerable to overheating because they spend so much time working in environments conducive to the problem, like ramps, taxiways, etc. In those open areas with so much concrete or asphalt, they are subjected to both direct heat, and that reflected from the ground. They can be subject to temperatures greatly in excess of the predicted temperature. They are also exposed to the greenhouse effect inside the aircraft."

USA: "There you go again, what have green houses to do with physiologic reactions to thermal stress? Besides, the only heat caused condition you've discussed so far is terminal stability. We know to avoid very high internal body conditions, so why not let us off the hook and stop babbling while you're ahead?"

Schliepforeber: "Be careful, you almost made sense that time. The main reason for concern with heat stress is its effect well below the fatal limit. Primarily, heat stress exaggerates any stress already present, and reduces our tolerance to other environmental factors like motion sickness or hypoxia. Naturally, then, aviators should allow themselves extra time to accomplish things in high temperature environments. Rushing about is exercise, und this physical exertion can increase the internal body temperature as much as 4 degrees. If it is possible, avoiding work in direct sunlight will help. If that's not possible, protective clothing is the best idea, but it has its problems. While this clothing will block the sunlight, it also interferes with evaporation und convection, so it should be loose und not excessive. They should force themselves to drink water, remember how much they are losing—up to four liters per hour! Another concern is loss of electrolytes, but this is complex und you should seek the advice of a physician for the proper compensation, so *don't* start eating salt tablets on your own!"

USA: "What, now you're suggesting we need instructions on how to consume capsules?"

Schliepforeber: "I'm surprised you aren't coached in breathing, too. As I was saying, there are other problems with heat, und I will define them now. Heat syncope is a sensation of giddiness or fatigue, and results from a loss of tone in the surface of blood vessels. If an aviator is going to experience this, it will most likely occur during physical exertion when first exposed to a high temperature environment und acclimatization has not occurred."

USA: "Hey, isn't that what you do to your car? I presume there's some special chemical one can drink that prevents all this heat stress stuff, you doctors are amazing . . . ."

Schliepforeber: "I don't normally reveal it but for you I make an exception, it's called arsenic. I'd be happy to provide you with a free one-year supply after I'm through here. In reality, acclimation is a process of adaptation. It's the body's self-protection from exposure to chronic high-temperature environments. More sweat glands are developed, circulating blood quantity is increased along with other thermoregulatory changes, but it takes several weeks.

Another problem is heat exhaustion due to profuse sweating while not drinking enough water. Symptoms include dizziness, thirst, and fatigue. The last problem I will talk about is heat stroke. This is the common name for the condition we already discussed, where the internal body temperature is very high. The symptoms include sudden onset of delirium und coma, und an unusual lack of sweating, since as we discussed, the hypothalamus stops working so good. These conditions are serious. The best thing to do is prevent them, since treatment is always more complicated. If one fails in prevention und they feel any signs of heat distress, they should do something immediately to cool down. Stop, get in the shade, drink some fluids, und if that still isn't enough—see a doctor quick. The only exception is heat stroke, mit that one don't hesitate, call a physician immediately, if not sooner!"

USA: "I simply must ask you this final question, Professor. I couldn't help noticing how you slip in and out of your accent. What gives?"

Schliepforeber: "Very observant. I really don't have an accent, but people expect me to have an accent, it helps my image and my credibility."

USA: "Thank you Doctor Schliepforeber. Our readers will be much better off now, having learned these interesting facts. Perhaps for our next interview we could discuss . . . ."

***(Editor's note*—the rest of the conversation, while quite colorful, isn't for the squeamish and couldn't be published anyway. So as they say, enjoy the sun and stay cool!)**

DUE TO A LACK OF PHOTOGRAPHIC CONTRAST BETWEEN TEXT AND BACKGROUND, THIS PAGE DID NOT REPRODUCE WELL.

The all-time hatcher of hazards . . .

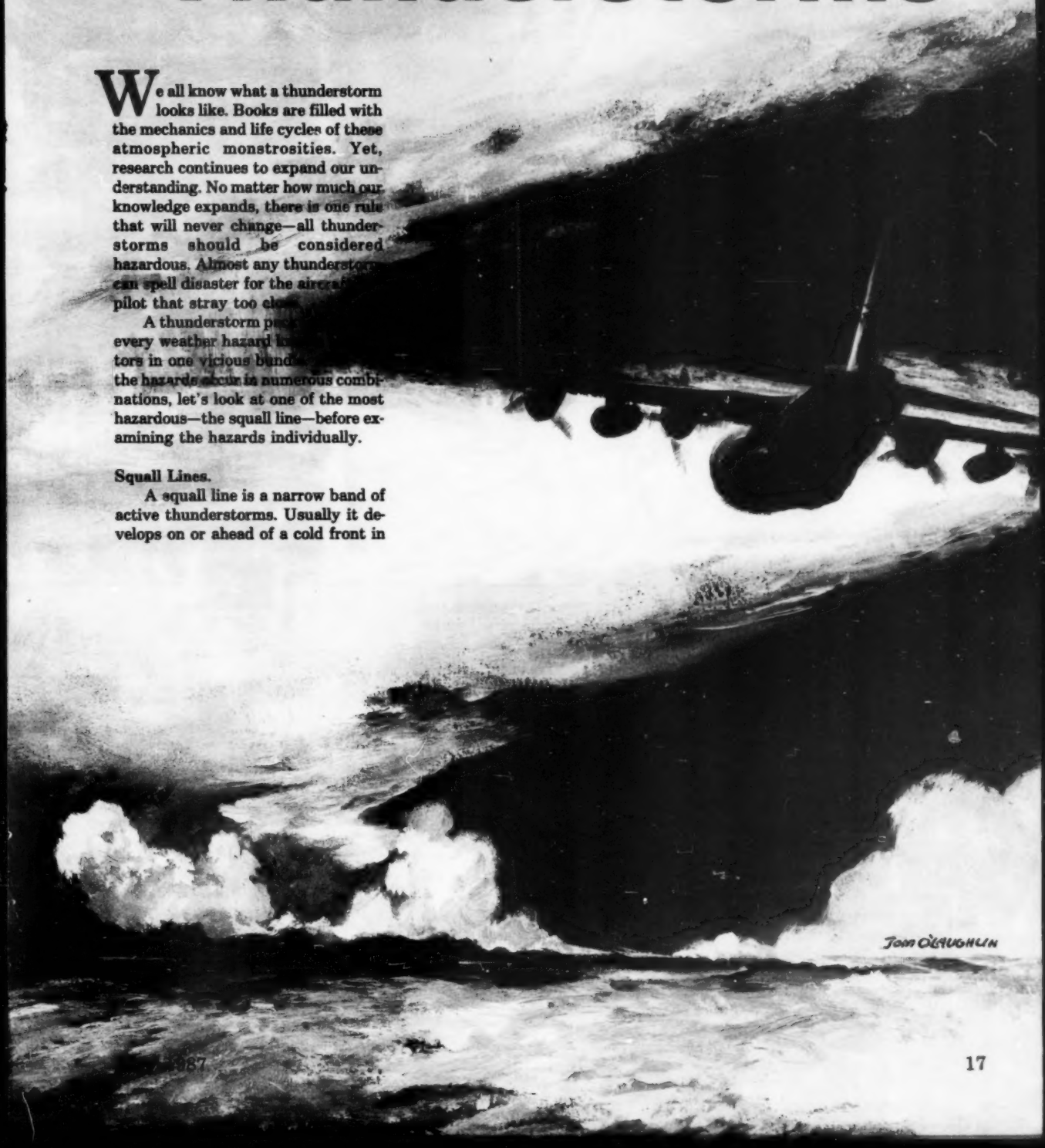
Thunderstorms

We all know what a thunderstorm looks like. Books are filled with the mechanics and life cycles of these atmospheric monstrosities. Yet, research continues to expand our understanding. No matter how much our knowledge expands, there is one rule that will never change—all thunderstorms should be considered hazardous. Almost any thunderstorm can spell disaster for the aircraft pilot that stray too close.

A thunderstorm packs every weather hazard known to aviators in one vicious bundle. Before the hazards occur in numerous combinations, let's look at one of the most hazardous—the squall line—before examining the hazards individually.

Squall Lines.

A squall line is a narrow band of active thunderstorms. Usually it develops on or ahead of a cold front in



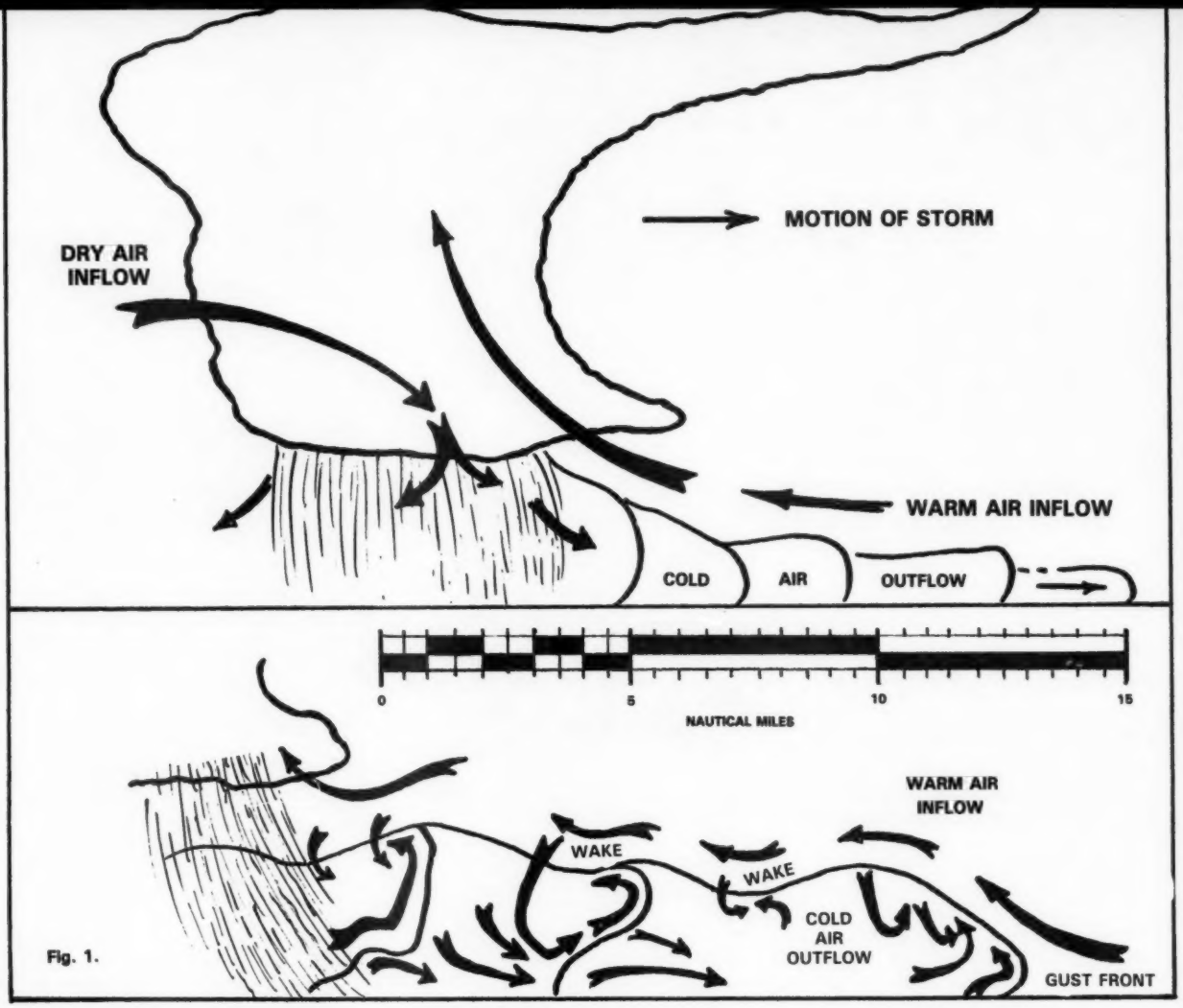


Fig. 1.

moist, unstable air, but it may develop in unstable air far removed from any front. The line may be too long to detour easily and too wide and severe to penetrate. It often contains thunderstorms in various stages of development and presents the single most intense weather hazard to aircraft. It usually forms rapidly, generally reaching maximum intensity during late afternoon and the first hours of darkness.

Tornados.

During the growth stage, thunderstorms draw air into their cloud bases with great vigor. If the incoming air has any initial rotating motion, it often forms an extremely concentrated vortex from the surface well into the cloud. Meteorologists estimate wind in such a vortex can exceed 300 knots; pressure inside the vortex is explosively low. The strong winds gather dust and debris and the low pressure generates a funnel-shaped cloud extending downward from the cumulonimbus base. It's called a "funnel cloud" if it doesn't reach the surface, a "tornado" if it touches down over land, or a "waterspout" if it touches down over water.

Tornadoes can occur with both isolated and squall line thunderstorms. The violent up and down drafts associated with convective weather always mean violent turbulence. Families of tornadoes have been observed as appendages of the main cloud extending several miles outward from a massive thunderstorm cell. Since the vortex extends well into the cloud, any aircraft caught in a severe thunderstorm could run into a hidden vortex and probably wouldn't come out in one piece.

Turbulence.

Hazardous turbulence is present in all thunderstorms, and a severe thunderstorm can destroy an aircraft. Strongest turbulence within the cloud occurs with shear between updrafts and downdrafts. Outside the cloud, shear turbulence has been encountered several thousand feet above and 20 miles laterally from a severe storm. The shear zone associated with the gust front is a low level turbulent area. Often, a "roll cloud" on the leading edge of a storm marks the top of eddies in this shear and signifies an extremely turbulent zone. Gust fronts often move far ahead (up to 15 miles) of the associated precipitation. A strong gust front causes a rapid and

sometimes drastic change in surface wind speed and direction ahead of an approaching storm. Figure 1 shows a cross section of a thunderstorm with areas outside the cloud where turbulence may be encountered.

Getting caught in a thunderstorm is no picnic. Turbulence makes it almost impossible to hold a constant altitude, and maneuvering in an attempt to do so will only increase stresses on the aircraft, possibly to the breaking point. Reducing to recommended turbulence penetration airspeed and letting the aircraft "ride the waves" by holding a constant attitude is about the only way to minimize the effects of turbulence. There's no sure way to pick "soft spots" in a thunderstorm. The surest method of survival is simply *stay away.*

Icing.

Thunderstorm icing can be extremely hazardous. Updrafts in a thunderstorm support abundant liquid water with relatively large droplet sizes that, when carried above the freezing level, becomes supercooled. When the temperature in an upward current cools to about -15 °C, much of the remaining water vapor sublimates as ice crystals; and above this level, at lower temperatures, the amount of supercooled water decreases.

This supercooled water freezes on impact with an aircraft. Clear icing can occur at any altitude above the freezing level; but at high levels, icing from smaller droplets may be rime or mixed rime and clear. The abundance of large, supercooled water droplets makes clear icing form very rapidly between 0 °C and -15 °C and encounters can be frequent in a cluster of cells.

Hail.

But don't worry too much about icing, the hail will knock it off! Hail competes with turbulence as the greatest thunderstorm hazard to aircraft. Supercooled drops above the freezing level begin to freeze. Once a drop has frozen, and other drops latch on, the frozen mass begins to fall. Caught in another updraft, up it goes again gathering more ice. This up and down race track continues until the hailstone is heavy enough to fall to the ground. Large hail occurs in severe thunderstorms with strong updrafts that have built to great heights. Hailstones can fall some distance from the storm core. Hail can be thrown from the top of a thunderstorm and therefore may be encountered in clear air several miles from dark thunderstorm clouds.

As hailstones fall through air with a temperature above 0 °C, they begin to melt and precipitation may reach the ground as either hail or rain. Rain at the surface does not mean the absence of hail aloft. Hail could accompany any thunderstorm, especially beneath the anvil of a large one. Even small hailstones can ruin your whole day (and your airplane).

Low Ceiling and Visibility.

Precipitation can seriously restrict visibility and lower the ceiling between the cloud base and the ground. These restrictions create the same problem as all ceiling and visibility restrictions; but the hazards are increased when associated with the other thunderstorm hazards of turbulence, hail, and lightning, and make precision instrument flying virtually impossible.

Effects on Altimeters.

Pressure usually falls rapidly with the approach of a thunderstorm, then rises sharply with the onset of the first gust and arrival of the cold downdraft and heavy rainshowers, falling back to normal as the storm moves on. This cycle of pressure change may occur in 15 minutes. If the pilot doesn't receive a corrected altimeter setting, the altimeter may be more than 100 feet in error.

Lightning.

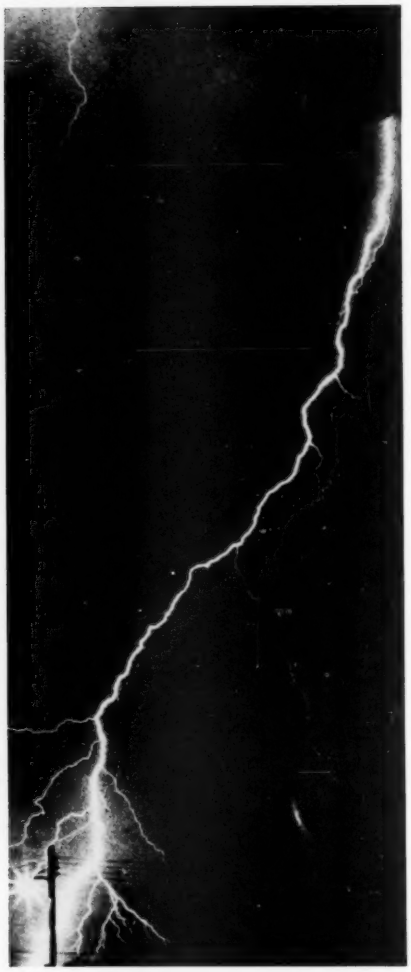
A lightning strike can puncture the skin of an aircraft and can damage communications and electronic navigation equipment. Lightning has been suspected of igniting fuel vapors causing explosions; however, serious accidents due to lightning strikes are rare. Nearby lightning can blind the pilot, rendering him momentarily unable to navigate either by instruments or visual reference. Lightning discharges, even distant ones, can disrupt radio communications on low and medium frequencies. Lightning generally occurs within $\pm 8°$ of the freezing level in clouds and in precipitation. Severe storms have a high frequency of lightning.

Engine Water Ingestion.

Turbine engines have a limit on the amount of water they can ingest. Updrafts are present in most thunderstorms, particularly those in the developing stages. If the updraft velocity in the thunderstorm approaches or exceeds the terminal velocity of falling raindrops, very high concentrations of water may occur. These concentrations can be more than the quantity of water engines are designed to ingest. Therefore, severe thunderstorms may contain areas of high water concentrations which could result in flameout or structural failure of one or more engines.

There's no known procedure that can completely eliminate engine damage or flameouts during massive water ingestion. Although the exact mechanism of water-induced stalls hasn't been determined, thrust changes may have an adverse effect on engine stall margins in the presence of massive water ingestion.

Avoiding severe storm systems is the only known effective way to prevent exposure to multiple engine damage or flameouts. If all else fails and you end up in these conditions, follow turbulence penetration procedures in your flight manual and especially avoid thrust changes unless airspeed is varying drastically.



Weather Radar.

While not a hazard in itself, ground or airborne radar can lead you into a false sense of security. Remember, both have their limitations. Thunderstorms build and dissipate rapidly. Therefore, don't attempt to plan a course between echoes. The best use of ground radar information is to isolate general areas and coverage of echoes. Avoid individual storms by visual sighting or by airborne radar. It's better to avoid the whole thunderstorm area than to detour around individual storms unless they're scattered.

Airborne weather avoidance radar is, as the name implies, for avoiding severe weather—not penetrating it. Whether to fly into an area of radar echoes depends on echo intensity, spacing between echoes, and the capabilities of you and your aircraft. Weather radar detects only precipitation; it does not detect turbulence. Therefore, the radar scope provides no assurance of avoiding turbulence. The radar scope also does not provide assurance of avoiding instrument weather from clouds and fog. Your scope may be clear between intense echoes; this clear area does not necessarily mean you can fly between storms and maintain visual sighting of them.

Avoid intense or extreme echoes by at least 20 miles; that is, such echoes should be separated by at least 40 miles before you fly between them.

DO'S AND DON'TS OF THUNDERSTORM FLYING.

Above all, remember this: Never regard any thunderstorm lightly, even when radar observers report echoes are of light intensity. Avoiding thunderstorms is the best policy. Following are some do's and don'ts of thunderstorm avoidance.

- Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front or downburst can cause low level turbulence or a shear zone which could cause loss of control.
- Don't attempt flying under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be disastrous.
- Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.
- Don't trust visual appearance as a reliable indicator of turbulence inside a thunderstorm, or as an indicator of storm severity.
- Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.
- Do circumnavigate the entire area if the area has 6/10 thunderstorm coverage.
- Do remember vivid and frequent lightning indicates the probability of a severe thunderstorm.
- Do regard as extremely hazardous any thunderstorm with top 35,000 feet or higher whether the top is visually sighted or determined by radar. In Alaska or Europe, severe thunderstorms can occur with tops below 20,000 feet.

If you cannot avoid penetrating a thunderstorm, following are do's BEFORE entering the storm:

- Tighten your safety belt and secure all loose objects.
- Plan and hold your course to take you through the storm in minimum time.
- Establish a penetration altitude below the freezing level or above the -15°C level to avoid the most critical icing.
- Verify pitot heat, wing and empennage, and engine anti-ice are on. Icing can be very rapid at any altitude and cause almost instantaneous power failure and loss of airspeed indications.
- Establish power settings for turbulence penetration airspeed recommended in your Dash One.
- Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.
- Disengage the altitude hold and speed hold modes of the autopilot if they're on. Just try to maintain a constant attitude. Letting the aircraft "ride the waves" will reduce airframe stress.
- If using airborne radar, tilt the antenna up and down occasionally. This permits you to detect other thunderstorm activity at altitudes other than your own.

During thunderstorm penetration:

- Do keep your eyes on your instruments. Looking outside the cockpit increases danger of temporary blindness from lightning.
- Don't change power settings; maintain settings for recommended turbulence penetration airspeed.
- Don't turn back once you are in the thunderstorm. A straight course through the storm will most likely get you out most quickly. In addition, turning maneuvers increase stress on the aircraft.

Y'all have a nice summer.

Adapted from: FAA Advisory Circular 1/20/83.

CRITICAL TRIANGLES OF AGREEMENT

(TIME/DIST vs IAS)

by Capt. James D. Price

After a few hours on static display duty, you know exactly what visitors are going to ask.

"Is that the gun?" referring to the pitot tube, and "Gee, look at all those instruments! How do you keep them all straight?"

I don't know about you, but at one time, that last question made me feel almost superhuman for a moment. When you think about it, the engineers who design our aircraft with "all those instruments" are pretty darn smart. There are back-up instruments to the back-up instruments in some aircraft, each driven by independent sources of information and various forms of power. You may not realize it, but all these instruments form corners of triangles, called "critical triangles of agreement."

To emphasize my point I will refer to some very unfortunate mishaps which could have been averted had someone in the cockpit applied the principle of the critical triangle of agreement. I'll also refer to some incidents which did *not* turn into mishaps because the critical triangle of agreement was employed.

Back in 1974, a Northwest Orient flight crew departed New York in a Boeing 727. They were on a charter flight—the first leg was to be flown to Buffalo, where they were to pick up a chartered group of passengers.

On climbout, through rain and turbulent clouds, the flight was routine until after passing through the freezing level. The crew then began experiencing a problem with airspeed control. It was high; the rate of climb was also higher than normal. They were light, so they expected the aircraft to perform better than usual, but not this well. They thought they had gotten into some weird upward gust, so they eased back on the yoke.

The rate of climb went even higher, as one would expect, with back pressure and increasing pitch. However, the airspeed also increased mysteriously. They thought it was a phenomenal gust they were experiencing and pulled back on the yoke even further. The airspeed increased still more. They fixated on the airspeed indicator and pulled harder on the yoke.

The crew violated the most basic premise of attitude flying by disregarding both the main and standby attitude indicators, and following one performance instrument.

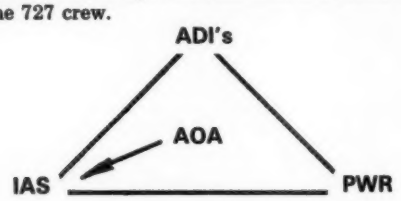
Even through the buffet, the pilot increased pitch in an effort to reduce airspeed. Why would anyone do something so ludicrous? As you know, the 727 is not exactly the SST, so in addition to the stall buffet which most aircrews experience in training, there is also Mach buffet, which occurs when the 727 reaches .9 to .93 Mach. Not many crews have experienced this buffet, since it is difficult to achieve.

The airspeed had "increased" so much, they were certain their aircraft was in Mach buffet, so they increased pitch more and even reduced power. The aircraft entered a full stall with only seconds to spare since they had wasted valuable minutes concentrating on the airspeed indicator.

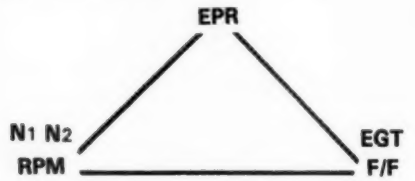
The principle behind critical triangles is nothing new. More than 200 years ago, a wise man observed, "If you desire to give a friend a clock, do not give him one, give him three so he will know the hour."

Think about that. With one clock, you only think you know what time it is. With two clocks that disagree, you may not discover which one is telling the correct time until it's too late. With three clocks you can be reasonably sure of the time if two agree. That is true in an aircraft as well, whether it's a Cessna 152, or a Boeing 727.

A critical triangle of agreement must be predicated on three totally independent sources of information and it must derive the information from performance and control instruments, with agreement at all times. Sometimes, in addition to the three clocks, there is an alarm clock which brings us back to reality. Let's examine the clocks available to the 727 crew.



They had both main and standby ADIs, climb power, and indicated airspeed available for the triangle. The one bad clock, the airspeed indicator, was confirmed by two other independent sources of information (control vs. performance). Even if climb power, which is set by engine pressure ratio (EPR), was incorrect, the critical triangle of agreement for power in the 727 would have allowed them to detect the bad power clock. That triangle is: Fan and turbine speed, (N1 and N2, known to most of us as rpm), EPR, EGT, and fuel flow.



The crew looked only at the airspeed "clock" and disregarded the two correct clocks, pitch and power. This added to an already confusing situation. Also, they had an alarm clock to wake them up: Angle of attack. The buffet started, but they reacted like all of us react to an early launch time. They reached over and shut off the alarm, disregarding its life-saving message, and went back to sleep. They continued to be just as confused and frightened about the "increasing airspeed" and stalled. They entered a spin and crashed. That mishap held a lesson for all of us, including me. But I missed the part about the critical triangle of agreement.

I separated from the Air Force in 1976 and while training at TWA's facility in Kansas City, this mishap was part of the course material. We discussed the mishap board findings, and the instructor pointed out that checklist discipline had broken down. Not only did the first officer fail to turn on the pitot heat, but the second officer did not back him up! As the aircraft climbed through the freezing level at 16,000 feet, ice formed on both pitot tubes. Sometimes that will cause airspeed to drop to zero, but ice in the pitot system can also seal certain passages and turn the airspeed indicator into an altimeter. That's what happened to the 727. The higher they went, the faster they thought they were flying.

Throughout my career as second officer on both the 707 and 727, this mishap lingered in my mind as I backed up the captain and first officer while they played with their switches. If they missed something, I was on them like "white on rice." Another point we discussed concerning the mishap was: It was extremely improbable to experience Mach buffet in a climb.

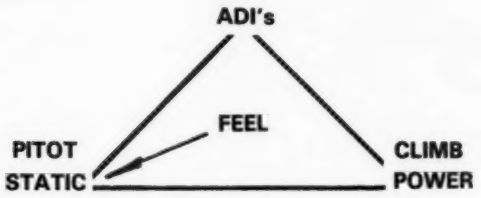
When I was an AC on the KC-135, I learned that when something went wrong, the best thing to do was check the applicable OFF-ON selectors in the "ON" position and command "Check the circuit breakers." This usually solved the problem, but if it didn't, it gave me time to think of which checklist to call for. Had the 727 crew done that, the pitot heat switch would have been found OFF—problem solved.

So, they missed that lesson in life. But, had they been aware of the critical triangle of agreement for pitch attitude, the mishap would have been only an incident. There was, however, no indication on the cockpit voice recorder that anyone on the flight deck had cross-checked the ADI. If fact, the dialogue on the tapes was so unprofessional, Northwest Orient management did not want their crews to hear the tapes. Had the captain lowered the nose to level flight and set cruise power, safe flight would have been possible.

The lessons from this mishap went much deeper than the improbability of Mach buffet, the importance of proper crew coordination, checking switches and circuit breakers, and good attitude flying. Critical triangles of agreement could have been discussed, but weren't. If the mishap had happened after the crew had boarded their charter passengers, that would have sold newspapers, and a discussion of the critical triangle of agreement may have followed.

Years ago, a United DC-6 departed Chicago's Midway Airport into a low ceiling. After entering the weather, all performance instruments began to read in reverse. The VSI, altimeter, and airspeed, all indicated a descent and stall. The captain, as you might imagine, had become quite familiar with pitch and power requirements for a normal

climb. The pitch and power he saw were the same indications he had always used, but his performance instruments were in complete disagreement with the control instruments.



The copilot's independently driven attitude indicator confirmed the captain's pitch indications were correct. With no AOA indicator installed in this aircraft, he depended on feel. The low airspeed indicated he should be in a stall, but there was no buffet. Feel was his alarm clock, had he needed it. The captain held his usual pitch attitude and broke out of the weather at 6,000 feet. This flight crew handled themselves professionally, exercised the principles of good attitude flying, and used the triangle of agreement to turn a confusing situation into confident control. Critical triangles of agreement not only exist for climb, cruise and approach, but they also exist for takeoff.

Two other pilots missed the critical triangle lesson of the Northwest Orient mishap. They were at the controls of an Air Florida 737 during takeoff from Washington National Airport on January 13, 1982. This mishap produced both fatalities and heroes.

It was a terrible day, with snow and slush covering the runway, and it was snowing hard. The first officer was to make the takeoff. He set the target takeoff EPR of 2.04, and as they started the takeoff run, something seemed unnatural.

The engine anti-ice, which also heats the inlet EPR probe, was not on and the EPR probe in the engine inlet had iced over. (EPR uses an inlet and exhaust probe to find the pressure ratios.) The probe in the exhaust has "natural deicing," so the EPR gauges received lots of thrust pressure and very little inlet pressure information, causing a higher than actual EPR reading.

At 14 seconds into the takeoff run, the first officer said to his captain, "That don't seem right, does it?"

Aside from the poor use of English, did you pick up anything from the first officer's statement? His feel was telling him the critical triangle of agreement wasn't in agreement!

Of the several engine instruments available, only the EPR gauges looked right, and performance didn't confirm that. Had they looked at other engine instruments, such as N1 and N2 rpms, EGT, and fuel flow, they would have discovered a low power setting.

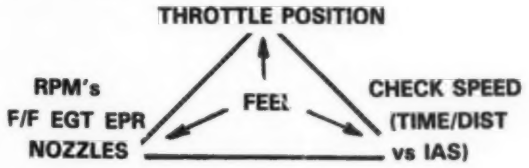
Three seconds later he repeated, "Ah, that's not right." His captain replied, "Yes, it is; there's 80 (knots)."

Nine seconds later the first officer said, "Ah, maybe it is," believing the EPR and the more experienced captain were correct. Then, only 4 seconds after that, "I don't know."

The 737 lifted off, but would not climb. It hit a bridge three-fourths of a mile off the end of the runway.

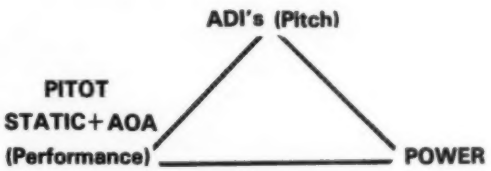
When the mishap report was final, we learned many causes for the mishap; ice and snow on the runway, improper deicing procedures, and the engine anti-ice was not used, resulting in unreliable EPR indications. They relied on one control instrument, and disregarded the critical triangle of agreement for takeoff power, when so many independent sources of engine thrust information were readily available. If they had recognized the problem at any time prior to impact and increased power, they would have flown out of the situation safely.

In the 737 as in the 727, during takeoff, there are several independent control sources for the critical triangle of agreement and performance source. Graphically, the triangle would look like this:



The alarm clock in the center of the triangle rings when things don't feel right. When that happens, don't shut it off—your feelings are trying to save your life! Check the triangle!

Let's tie this all together with a general, all-purpose, triangle of agreement for all inflight conditions. The three points of the triangle are:



The pitot static instruments and AOA vs. the power instruments vs. the attitude instruments.

Sound familiar? It's also known as pitch, power, and performance instrument flying.

Become familiar with pitch, power, and performance indications for a myriad of normal flight conditions, and do it now! If you don't know what to expect in normal situations, then it's difficult to complete the triangle when abnormal and confusing situations arise. Practice the principles of the critical triangle of agreement on each aircraft and simulator sortie. You'll avoid mistakes that sometimes catch even old pros.

I finally made it to the static display at Fairchild and some little old lady remarked, "Look at all those instruments!" I just smiled and humbly thought, "Yup, and I need every one of 'em."

Courtesy Business Aviation Safety Journal

Flying-Hour Milestones

10,000

CMSgt. Walter L. Buckman, Jr., 710 MAS
SMSgt. Donnie A. Garnes, 3 MAS

5,000

Lt. Col. Richard P. Bihler, 109 TAS
Lt. Col Robert A. Conlee, 58 MAS
Lt. Col. Ronald S. Crump, 50 TAS
Lt. Col. Milton O. Payne, Jr., 55 WRS/CC
Lt. Col. Roy J. Spencer, Jr., 928 TAG
Maj. Michael A. Gecan, 10 MAS
Maj. James S. Goehle, 310 MAS
Maj. Daniel R. Ittner, 58 MAS
Maj. Calvin E. Kissick, 58 MAS
Maj. Bruce W. Markus, 301 TAS
Maj. David K. Moffitt, 928 TAG
Maj. Jeffrey E. Todd, 356 TAS
Capt. Michael W. Arnold, 55 WRS
Capt. Francis A. Doyle, 57 MAS
SMSgt. Richard D. Hayes, Jr., 356 TAS
SMSgt. Claude A. Irelan, III., 20 MAS
SMSgt. Raymond J. Kouri, 58 MAS
SMSgt. Robert J. Regan, 928 TAG
MSgt. Paul C. Fiester, 312 MAS
MSgt. Charles P. Hayes, 30 MAS
MSgt. Michael A. Hedrick, 710 MAS
MSgt. Donald Q. Kubik, 39 TAS
MSgt. Darvin L. Smith, 109 TAS
MSgt. Lonnie A. Williams, 57 MAS
TSgt. Frank Gordon, 57 MAS
TSgt. Wayne F. Marter, 30 MAS
TSgt. Michael L. Piasecki, 30 MAS
TSgt. Edward P. Rodriguez, 37 TAS
TSgt. Thomas J. Sisemore, 57 MASS
TSgt. Grady W. Steen, 58 MAS
SSgt. Stephen Banks, 30 MAS
SSgt. Thomas W. Carey, Jr., 30 MAS
SSgt. Steven A. Hondel, 57 MAS

2,500

Maj. Robert A. Smith, Det 6, 40 ARRS
MSgt. Richard H. Davis, Det 6, 40 ARRS
TSgt. Gary L. Willis, 1 HS
SSgt. Antone F. Mindora, 1 HS

Ranks and units are those at time of award. See MACR 900-3 for details on how to apply for your own milestone award.

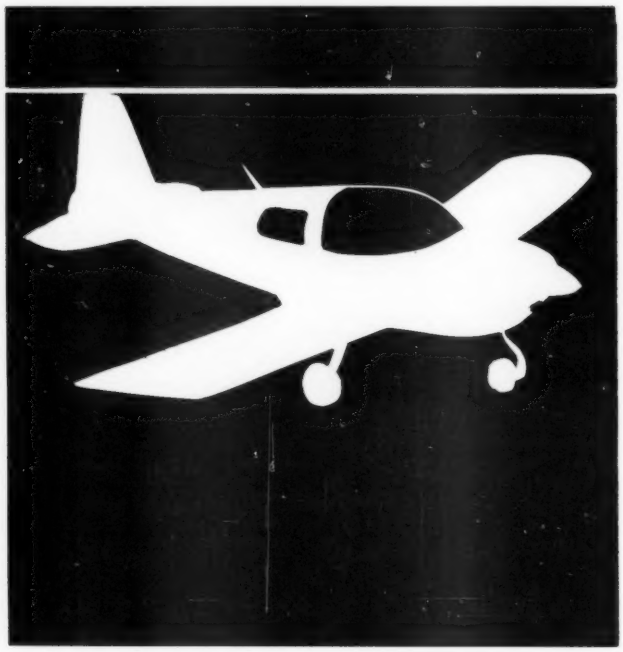
AERO CLUB FLIGHT LESSON

A lot of things went wrong.

by Maj. Thomas C. Weinzierl
Supervising Editor

As I sit here pondering my fate, trying to decide what pearls of wisdom to pass to my readers, an aero club mishap report that contains some lessons for the driver of any airplane suddenly crosses my desk. Aside from rescuing me from my predicament, it again proved that the best stories come from real life, not from the frazzled brain of a *TMF* supervising editor.

The pilot launched in his single engine, low wing trainer, on a local proficiency flight. He held a commercial license with multi-engine and single engine land ratings and was instrument rated. He had over 1,000 hours flying time and was an active aero club member. The flight proceeded normally until the pilot entered downwind for a planned touch-and- go at a nearby airport. During landing checks, he attempted to move the fuel selector switch from the right tank counterclockwise to the left (fuller) tank. This was standard procedure. He inadvertently turned the switch past the detent for the left tank. The switch had actually stopped about 1 inch beyond the detent, toward the unmarked "OFF" position. The engine continued to run normally until shortly after the pilot began his base turn. He began the turn at approximately 1,000 feet; the engine quit at 800. It had run for 20 to 30 seconds after the pilot moved the fuel switch.



The pilot lowered the nose to maintain best glide speed and selected what he thought was a suitable landing field. He did not attempt to restart the engine using the "Engine Power Loss In Flight" procedure because he thought he was too close to the ground. He then found he was too high to land in the first field he'd selected. He chose another field and performed a successful soft field approach and landing. The airplane rolled about 200 yards without damage to itself or its occupants.

Of course, the investigation centered on the fuel selector switch. The safety device that prevents inadvertent "OFF" selection was not operating. This spring-loaded latch is designed to mechanically prevent the switch from moving past the "Left Tank" detent to the "OFF" position. However, when exposed to sunlight, the plastic cover for the fuel selector panel expanded and put downward pressure on the latch. This prevents the latch from doing its job. Even though the latch might be in its proper position when checked, it could be pushed aside with "normal" fuel selector switch operation. Once pushed aside, (under the lip of the plastic cover) the latch remained in that position. The latch is not part of any inspection or lubrication checklist.

Finally, the "OFF" position label is a decal and was missing on this aircraft. This might lead a pilot new to the airplane to believe there were only two positions: "Right" or "Left" tank. It appeared the safety latch had been "inop" for some time. It had never been written up in the aircraft forms. Besides fixing the latch, the club painted the "OFF" label on the fuel selector panel.

This mishap gave the aero club, and us, a good chance to look in depth at such things as knowledge, proficiency, and responsibility. During the investigation, it became apparent many aero club pilots weren't as familiar as they should be with certain critical action procedures. Some situations, such as this one, require immediate actions by the pilot. In this case, the propeller continued to rotate, and had the pilot begun the "Engine Power Loss In Flight" checklist, he would probably have been rewarded with a restart. This is particularly true since the first step in the checklist is "Fuel Selector—Switch to Other Tank Containing Fuel." He believed he didn't have time to start the checklist but he did have time to change landing sites. Granted, he did a nice piece of flying after the engine died, but one step on the checklist during his approach *may* have helped him fly out of his difficulty. How's your emergency procedure knowledge? Your knowledge should go well beyond the bold face procedures to those that should also become "second nature," even though they're not mandatory memory items. Which annunciator lights on your panel would you abort a takeoff for?

Proficiency is something you don't just achieve in the local pattern. It's something you can work on during every mission. Perhaps if the mishap pilot had practiced more "what if my engine quit right now?" drills during previous flights, and ran through the checklist, he would have been ready. MAC pilots spend a lot of time cruising on autopilot and should take advantage of the time available to study the actions necessary to perform critical emergency actions. (Just don't ignore your primary job.)

Responsibility is really a combination of knowledge and proficiency. You have the responsibility to yourself and your fellow crewmembers to be as knowledgable and proficient as possible. Did the mishap pilot really know there was *supposed* to be an "OFF" label on the fuel selector panel? If he didn't, he neglected his responsibility to know his airplane. How many other pilots noticed it was missing and didn't report it? Maybe they just lived with it and assumed other pilots would too. They neglected their responsibility to protect their fellow pilots. At least MAC crewmembers never do that.

Do they?

FORGET SOMETHING?

During a transition and emergency procedures training sortie, the pilots of an HH-1H briefed and initiated simulated fuel control failure. However, after lowering collective, the pilot failed to reduce the throttle to flight idle *before* he moved the fuel control switch to the emergency position as called for by the "bold face" emergency procedure contained in the flight manual. The entire mishap sequence happened so fast the IP in the other seat was unable to prevent it, but did manage to recover the aircraft safely after the engine and rotor began to over speed. The result of this memory lapse included over $45,000 of collateral equipment damage and inspections. The point should be clear; reaction to any emergency *must* be timely, but not accomplished *so* rapidly that they are accomplished improperly.

QUICKSTOPPERS

A SHOCKING EXPERIENCE

This C-130 crew was on a local proficiency flight, returning to their eastern U.S. staging base when they received the greatest shock of their lives. The aircraft was flying at 6,000 feet MSL, in IMC and moderate rain showers with OAT of 0 °C, when they heard a loud "bang" accompanied by a bright flash of light on the flight deck. Taken aback by the unexpected jolt, the crew initiated Smoke and Fumes Elimination checklist procedures. The crew soon realized they had no fire on board but did note that number 3 engine instruments had frozen momentarily, but soon returned to normal operation. Experiencing no further problem, the crew pressed on to destination. The subsequent approach and landing were uneventful.

Post flight aircraft inspection revealed two holes below the pilot's windshield, one hole on the right elevator's trailing edge, and some sheet metal damage. Additionally, the number 3 engine oil indicator and the right pitot tube were damaged.

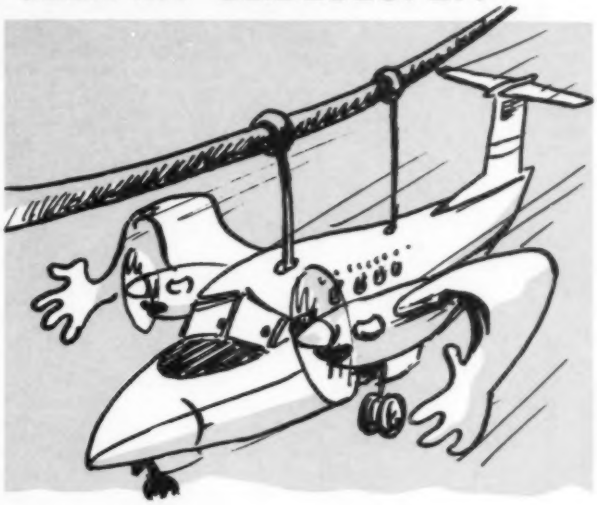
BUT HE SAID HE WOULD STOP!!

The operator of a civilian light aircraft is better off today due largely to the vigilance of an air traffic controller from Dover AFB. Seems a pilot was cleared for takeoff at about the same time the driver of a civilian contractor's ground vehicle requested clearance across the active runway. As the aircraft entered the runway to commence takeoff roll, the vehicle proceeded across the hold line. An alert controller spotted the incursion and canceled the aircraft's takeoff clearance. Luckily, the aircraft was able to abort in time. The vehicle was stopped, per tower instruction, prior to crossing the runway's edge and disaster was averted—this time. The point is, however, *all* crewmembers must be ever-vigilant for unauthorized runway incursions, particularly at airfields with a lot of traffic. Remember, although runway incursions are events which most aircraft operators are conscious of and avoid, they may be as simple as rolling through a stop sign to a ground vehicle operator.

PARDON ME, HAVE YOU SEEN MY GLIDESLOPE??

This C-12 had just turned final on the ILS front course and was about to intercept the glide slope when both the pilot's *and* copilot's glide slope indicators malfunctioned. The pilot's indicator showed full scale deflection above the glide slope and the copilot's indicator showed the aircraft centered on glide slope when, according to PAR radar, the aircraft was below glide slope. No glide slope fail flags appeared during the approach. Attempts to regain reliable glide slope indications by switching momentarily to TACAN were unsuccessful. Course guidance appeared normal throughout the approach and the aircraft landed uneventfully in VMC.

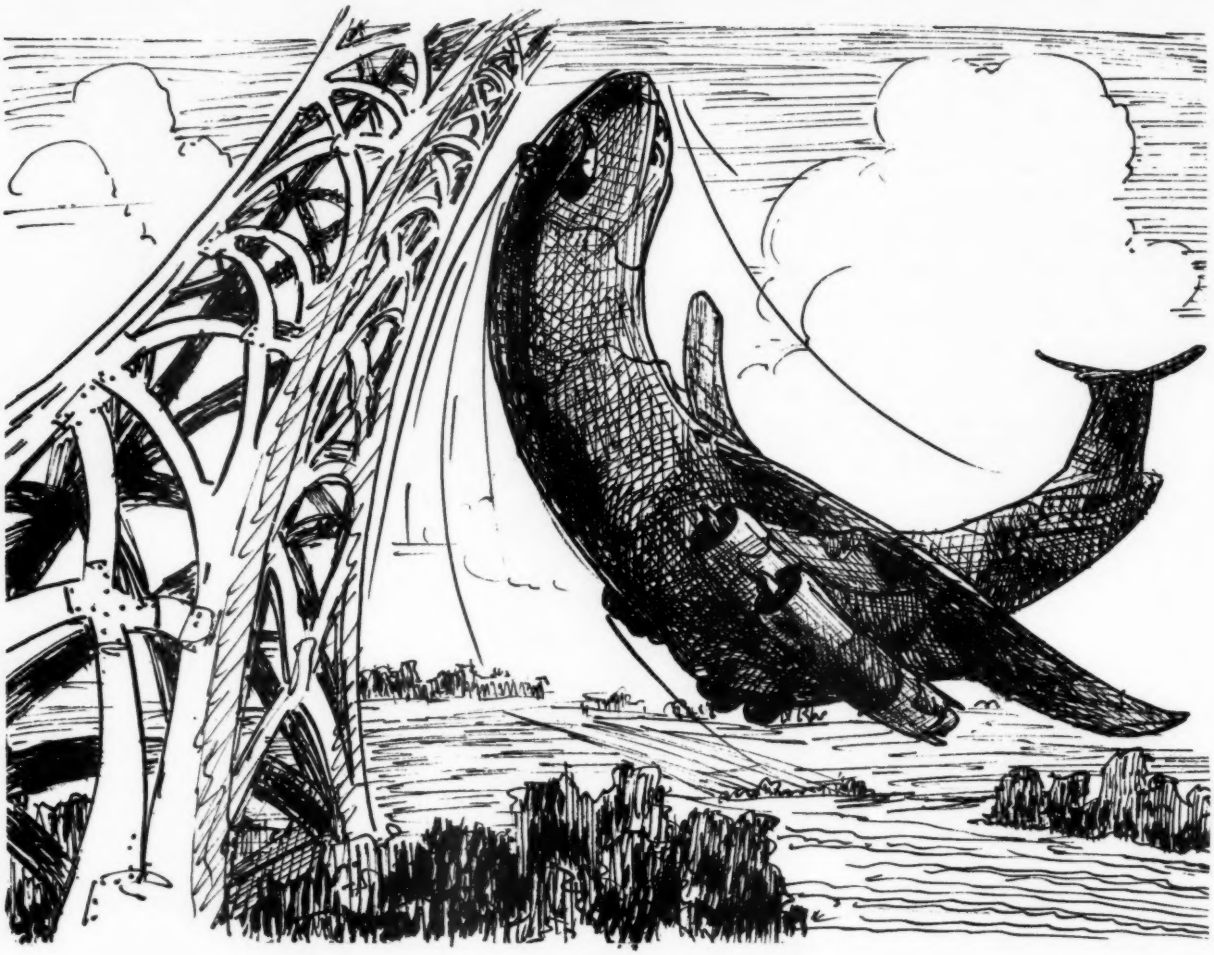
Contract maintenance was unable to duplicate the malfunction or determine the cause. This same aircraft flew two days later and experienced a similar malfunction even though the aircraft was fitted with revised circuit boards supposed to correct this problem. No other corrective action was recommended other than continued documentation of navaid failures and resulting contractor corrective actions.



WINCH WORRY

While practicing hoist operations in a hover, the "A" frame winch on this CH-3 wouldn't stop reeling in after release of the pilot's collective hoist control switch. The hoist cable continued reeling in past the up limit switch, tearing a tie-down ring (rated to withstand a 2,500 lb pull) from the cabin floor. Subsequently, the cable and pulley system hit the flight engineer in the lower abdomen but didn't cause serious injury. A Category I Materiel Deficiency Report was submitted on the winch control box and the mishap investigator recommended operators of similar equipment be warned of possible equipment damage and personnel injury which may be associated with this type of failure.

QUICKSTOPPERS



TV TOWER TRAUMA

While flying at 2,000 feet MSL toward a local area drop zone, the C-141 crew came face to face with near disaster in the form of a 2147-foot tower. The mission was a personnel airdrop training sortie and the "close encounter" took place on a published VFR route. As the mission proceeded toward the DZ, the subject tower popped into the pilot's view. The quick-thinking aviator immediately took evasive action by executing a 1½-2G climb combined with a steep left bank. The aircraft missed the tower; however, two of the paratroopers on board were injured due to the abrupt nature of the maneuver.

The ensuing investigation initially focused on the OPORD that established the VFR route. This order was published before the tower was constructed and mandated a minimum altitude of 2,000 feet on the route segment—the minimum altitude hadn't been changed to reflect the new 2147-foot tower.

The investigator also discovered the unit's tactics shop personnel were aware of the tower's presence on the route and had placed a notice at the command post window and base operations informing aircrews of the location and height of the new tower. Additionally, command post personnel routinely briefed transient aircrews regarding this same information. Despite these efforts, the mishap crew missed this information. They did, however, discover the tower in the Chart Updating Manual (CHUM). Unfortunately, *both* pilot *and* navigator misplotted the tower on *both* their navigation charts. This caused the mishap.

AFTER DEADLINES

CONTRACT TRAINING FOR C-130 AIRCREWS—Some training for Military Airlift Command C-130 aircrew members will soon be contracted out. The Aeronautical Systems Division at Wright-Patterson AFB, Ohio, will award a contract which furnishes MAC with a ground-based Aircrew Training System (ATS).

The C-130 ATS is a computer-based integrated training system which will help qualify C-130 aircrews while optimizing aircraft use. It is also capable of providing management information and assisting with courseware development. The system will train pilots, navigators, flight engineers, and loadmasters in normal/emergency procedures and wartime tactics. Air Force installations to receive the system are: Little Rock AFB, Arkansas; Dyess AFB, Texas; Pope AFB, North Carolina; Kirtland AFB, New Mexico; and Clark AB, Republic of the Philippines. In addition, the system will provide remote site training capability for aircrews at Elmendorf AFB, Alaska; Rhein-Main AB, West Germany; and Yokota AB, Japan. MAC will continue to provide flight instructors for all in flight training and flight evaluations.

C-141 FLEET TO UNDERGO WING MODIFICATION—Military Airlift Command's C-141B Starlifter aircraft are about to undergo the largest repair program since the stretch modification.

Repairs will be done at Warner Robins Air Logistics Center, Robins AFB, Georgia, and involves replacing center wing portions of 267 C-141Bs. Under the program, 204 wing portions will be replaced as part of regular programmed depot-level maintenance at Warner Robins. The rest of the work will be performed by a contractor. This modification will help extend aircraft life from 30,000 to 45,000 flying hours. The work also includes refurbishing the dry bay area beneath the center wings. Fifty C-141s will be repaired each year until the project is completed in 1992.

MAC WINS SPECIAL ACHIEVEMENT AWARD—Military Airlift Command was selected as one of the recipients of the Chief of Staff Special Achievement Award. MAC received this award for its outstanding flight safety record in 1986. During that period MAC equalled the second fewest class A aircraft mishaps in the Command's history and didn't experience a single class B flight mishap.

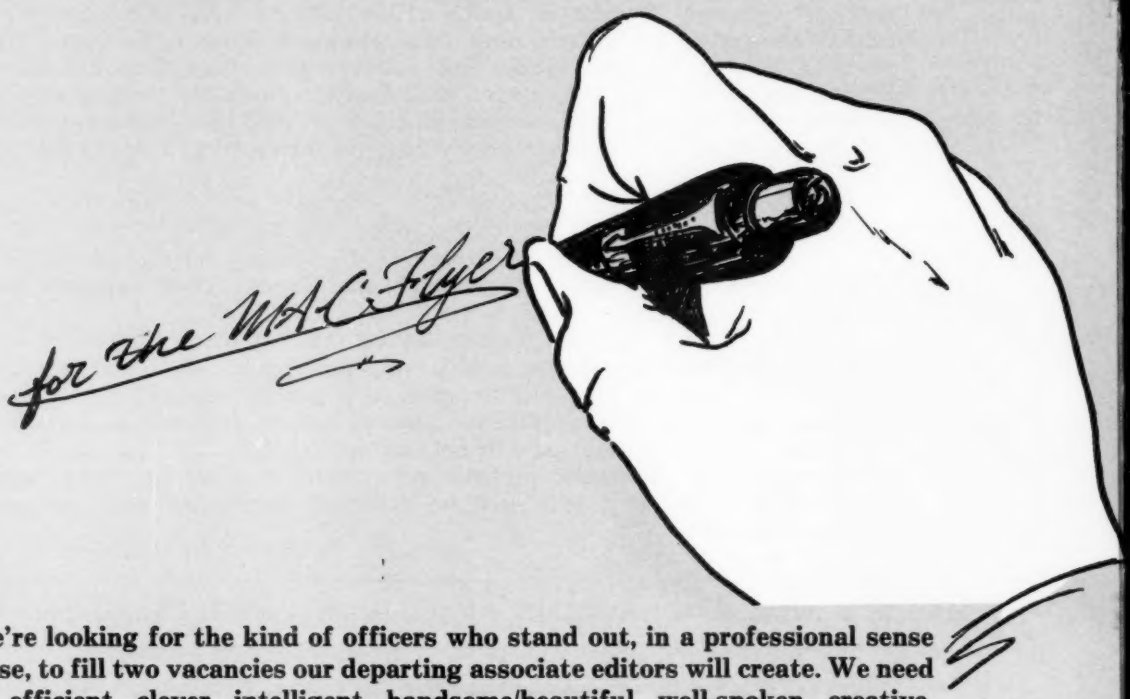
MAC CONTRACT FLIGHTS RETURN TO OAKLAND—Incoming MAC overseas flights will return to Oakland International Airport on 3 April 87, after a two-year absence.

According to Col. John T. Quirk, Director of Passenger and Traffic Management at HQ MAC, Scott AFB, Illinois, "The shift of flights from San Francisco IAP was made in conjunction with reassignment of federal customs agents to the Oakland airport. With the return to Oakland, MAC hopes to eliminate the congestion present at San Francisco IAP and improve arrival time for passengers completing their travel to St. Louis, MO., via Oakland."

Oakland is increasing the number of domestic carriers to provide easy connections for onward travelers. Also, the Oakland USO facility is being remodeled to better serve military members and their families.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1987 754-015/40008

We're looking for a few good pens.



We're looking for the kind of officers who stand out, in a professional sense of course, to fill two vacancies our departing associate editors will create. We need proud, efficient, clever, intelligent, handsome/beautiful, well-spoken, creative, thorough, informed, and enthusiastic individuals who possess superb writing skills. That's right, we're lowering our standards. We know we can't *really* replace the editors we now have. Sometimes though, you just have to move on, and so it is with our current modest authors (who'd undoubtedly be Pulitzer winners except for GPO restrictions), both of whom edited this ad. We'll have positions available in May and July of 1987 for two rated captains and/or junior majors. Flight safety experience is a plus; a sense of humor is required; modesty is optional. Before concluding you haven't a chance of qualifying, remember: a journalism or public affairs background *isn't* a requirement (though it certainly won't disqualify you). Check through a few issues of *TMF* and you'll see we write just the way we talk (and we're working on improving the way we talk). This could be your big break! If your're even remotely interested (not to imply the kind of tour this is), give Major Weinzierl, Supervising Editor, a call at AV 576-3534/5542.